

# UROLOGY

Dr. S. Herschorn

Ryan Groll, Alexandra Nevin and David Rebuck, chapter editors

Gilbert Tang, associate editor

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# HISTORY AND PHYSICAL

## HISTORY

- pain: location (CVA, genitals, suprapubic), onset, quality (colicky, burning), severity, radiation
- associated symptoms: fever, chills, weight loss, nausea, vomiting
- irritative (storage) symptoms: frequency, nocturia, dysuria, urgency
- obstructive (voiding) symptoms: hesitancy, straining, intermittency, decreased force or caliber of stream, prolonged voiding, post-void dribble, incomplete emptying
- incontinence: stress incontinence, urge incontinence, incontinence without emptying (overflow), history of neurological problems, past pregnancies and method of delivery, past abdominal-pelvic operations
- urine: hematuria, pneumaturia, foul smell, colour (cloudy, white, orange)
- infection: urethral discharge (colour, amount, smell), sexual history, UTIs, external genital skin lesions, lymphadenopathy
- others: renal calculi, infertility, erectile dysfunction, congenital disorders, hematospermia family history of urological disease, history of pelvic/perineal trauma

## PHYSICAL

- inspection
  - abdomen: masses, scars from previous operations, suprapubic distension, edema of skin, hair distribution
  - penis: circumcision (if not circumcised retract foreskin), phimosis/paraphimosis, epispadias, hypospadias, urethral discharge (colour, consistency), superficial ulcers or vesicles, venereal warts, meatal stenosis
  - scrotum: testicular atrophy, testicular asymmetry, balanitis, dilated veins (varicocele) on standing, scrotal erythema/edema/cysts/hemangiomas
  - body habitus: secondary sexual characteristics
- palpation
  - abdomen: masses, CVA tenderness, suprapubic tenderness, auscultate upper abdominal quadrants for systolic bruits (renal artery stenosis/aneurysm), inguinal lymphadenopathy
  - penis: Peyronie's plaques, penile masses, penile tenderness
  - scrotum: scrotal tenderness/masses (size, consistency, location, mobility, shape), hernia, hydrocele, spermatocele, spermatic cord (varicocele, fusiform enlargement, thickening of the cord), absence of vas deferens, epididymal size/induration/tenderness
  - DRE: anal sphincter tone, perianal sensation, prostate → size, consistency (rubbery, hard, boggy, indurated), nodularity (size, location), tenderness, warmth, mobility

# KIDNEY AND URETER

## RENAL STONE DISEASE

### Incidence

- 10% of population
- male:female = 3:1
  - 50% chance of recurrence by 5 years
  - peak incidence 30-50 years of age

### Clinical Presentation

- urinary obstruction → distension → pain
  - flank pain from renal capsular distension (non-colicky)
  - severe waxing and waning pain radiating from flank to groin, testis, or tip of penis, due to stretching of collecting system or ureter (ureteral colic)
  - never comfortable, always moving nausea, vomiting, hematuria, usually microscopic (90%), occasionally gross symptoms of trigonal irritation (frequency, urgency), diaphoresis, tachycardia, tachypnea
- +/- fever, chills, rigors secondary to pyelonephritis

### Differential Diagnosis of Renal Colic

- other causes of acute ureteral obstruction
  - UPJ obstruction
  - sloughed papillae
  - clot colic from gross hematuria
- gynecological causes (ectopic pregnancy, torsion of ovary cyst)
- radiculitis (L1 nerve root irritation)
  - herpes zoster
  - nerve root compression
- pyelonephritis (fever, chills, pyuria)
- acute abdominal crisis (biliary, bowel)
- leaking abdominal aortic aneurysm

### Location of Stones

- calyx
  - may cause flank discomfort, recurrent infection or persistent hematuria
  - may remain asymptomatic for years and not require treatment

## KIDNEY AND URETER ... CONT.

- ☐ pelvis
  - tend to cause UPJ obstruction renal pelvis and one or more calyces
  - staghorn calculi
  - often associated with infection
  - infection will not resolve until stone cleared
  - may obstruct renal drainage
- ☐ ureter
  - < 5 mm diameter will pass spontaneously in 75% of patients the three narrowest passage points for upper tract stones include: UPJ, pelvic brim, UVJ

### Investigations

- ☐ screening labs
  - CBC → elevated WBC in presence of fever suggests infection
  - lytes, Cr, BUN → to assess renal function
- ☐ urinalysis
  - routine and microscopic (WBCs, RBCs, crystals), culture and sensitivity
- ☐ KUB x-ray
  - to differentiate opaque from non-opaque stones
  - 90% of stones are radiopaque
- ☐ spinal CT
  - no contrast; good to distinguish radiolucent stone from soft tissue filling defect
- ☐ abdominal ultrasound
  - may demonstrate stone (difficult in ureter)
  - may demonstrate hydronephrosis
  - caution: operator dependent
- ☐ IVP (**see Colour Atlas U2**) (preceded by KUB)
  - anatomy of urine collecting system
    - degree of obstruction
    - extravasation if present
    - renal tubular ectasia (medullary sponge kidney)
  - uric acid stones → filling defect retrograde pyelography
  - occasionally required to delineate upper tract anatomy and localize small calculi
- ☐ strain all urine → stone analysis
- ☐ later (metabolic studies for recurrent stone formers)
  - serum lytes, calcium, phosphate and uric acid, creatinine and urea
  - PTH if hypercalcemic
  - 24 hour urine x 2 for creatinine,  $\text{Ca}^{2+}$ ,  $\text{PO}_4^{3-}$ , uric acid, magnesium, oxalate, citrate

### Acute Management

- ☐ medical
  - analgesic (Tylenol #3, demerol, morphine) +/- antiemetic
  - NSAIDs help lower intra-ureteral pressure
  - +/- antibiotics for UTI
  - IV fluids if vomiting
- ☐ indications for admission to hospital
  - severe persistent pain uncontrolled by oral analgesics
  - fever → infection
  - high grade obstruction
  - single kidney with ureteral obstruction
  - bilateral ureteral stones
  - persistent vomiting
- ☐ surgical
  - ureteric stent
  - high grade obstruction
  - single kidney
- ☐ radiological
  - percutaneous nephrostomy (alternative to stent)

### Elective Management

- ☐ medical
  - conservative if stone < 5 mm and no complications
  - alkalinization of uric acid and cystine stones may be attempted (potassium citrate)
  - patient must receive one month of therapy before being considered to have failed
- ☐ surgical
  - kidney
    - extracorporeal shock wave lithotripsy (ESWL) if stone < 2.5 cm, stone resistant to ESWL
    - + stent if 1.5-2.5 cm
    - percutaneous nephrolithotomy
      - stone > 2.5 cm
      - staghorn
      - UPJ obstruction
      - calyceal diverticulum
      - cystine stones (poorly fragmented with ESWL)
    - open nephrolithotomy
      - extensively branched staghorn

- ureter
  - ESWL is primary modality of treatment
  - ureteroscopy
    - failed ESWL
      - highly efficacious for lower ureteral calculi
    - ureteric stricture
    - reasonable alternative for distal 1/3 of ureter
  - open ureterolithotomy
    - rarely necessary (failed ESWL and ureteroscopy)

### Stone Pathogenesis

- ❑ factors promoting stone formation
  - stasis (hydronephrosis, congenital abnormality)
  - medullary sponge kidney
  - infection (struvite stones)
  - hypercalciuria
  - increased oxalate
  - increased uric acid
- ❑ loss of inhibitory factors
  - magnesium (forms soluble complex with oxalate)
  - citrate (forms soluble complex with calcium)
  - pyrophosphate
  - glycoprotein

### STONE TYPES

#### Calcium Stones

- ❑ account for 80 - 85% of all stones
- ❑  $\text{Ca}^{2+}$  oxalate most common, followed by  $\text{Ca}^{2+}$  phosphate description
  - grey or brown due to hemosiderin from bleeding
  - radiopaque (**see Colour Atlas U1**)

#### Etiology

- ❑ hypercalciuria (60-70% of patients)
  - 95% of these patients have normal serum calcium levels
  - 5-10% of people without stones have hypercalciuria
  - absorptive causes (majority of patients)
    - increased vitamin D sensitivity → idiopathic
- ❑ hypercalciuric  $\text{Ca}^{2+}$  stones
  - sarcoidosis → ↑ production of  $1,25(\text{OH})_2$  vit D
  - abnormal vitamin D metabolism → ↑  $1,25(\text{OH})_2$  vit D
  - excess vitamin D intake
  - increased  $\text{Ca}^{2+}$  intake (milk alkali syndrome)
  - renal phosphate leak → ↓  $\text{PO}_4$  → ↑  $1,25(\text{OH})_2$  vitamin D → absorptive hypercalcemia
  - treatment
    - cellulose phosphate (decrease intestinal absorption of  $\text{Ca}^{2+}$ ) or orthophosphates (inhibit vitamin D synthesis)
  - resorptive cause (i.e. ↑  $\text{Ca}^{2+}$  from bones)
  - hyperparathyroidism
  - neoplasms (multiple myeloma, metastases)
  - Cushing's disease
  - hyperthyroidism
  - immobilization
  - steroids
  - renal leak of calcium
  - distal renal tubular acidosis (RTA I) → 6.0 pH + ↓ citrate → ↑  $\text{CaPO}_4$  stones
    - treat with  $\text{HCO}_3^-$  to increase citrate
  - medullary sponge kidney (tubular ectasia)
    - anatomic defect in collecting ducts; 5-20% of  $\text{Ca}^{2+}$  stone formers
- ❑ idiopathic (25-40% of patients)
  - normocalcemic
  - normocalciuric
  - may have ↓ citrate; ↓ Mg; ↑ oxalate; ↑ urine acidity; dehydration
  - treatment
    - hydrochlorothiazide (HCTZ) 25 mg PO daily → ↓  $\text{Ca}^{2+}$  in urine
    - increase water intake
- ❑ hyperuricosuria (25% of patients with  $\text{Ca}^{2+}$  stones)
  - uric acid becomes insoluble at pH of < 5.8 uric acid acts as nidus for  $\text{Ca}^{2+}$  stone formation by constantly acidic urine, dehydration, or both
  - treatment
    - add allopurinol if uric acid excretion > 5 mmol/day
- ❑ hypocitraturia (12% of patients)
  - associated with type I RTA or chronic thiazide use
  - treatment
    - potassium citrate

- ❑ hypercalcemia (5% of patients)
  - primary hyperparathyroidism
  - malignancy
  - sarcoidosis
  - increased vitamin D
  - hyperthyroidism
  - milk-alkali syndrome
- ❑ hyperoxaluria (< 5% of patients)
  - insoluble end product of metabolism
  - enteric hyperoxaluria (patients with malabsorption)
  - inflammatory bowel disease (IBD)
  - short bowel syndrome
  - exogenous causes
  - dietary increase (caffeine, potatoes, rhubarb, chocolate, vitamin C)
  - primary increase in endogenous production (rare autosomal recessive disorder)
  - treatment
    - increase water intake, avoid oxalate-containing foods
    - oral calcium or cholestyramine

**Struvite Stones**

- ❑ female patients affected twice as often as male patients
- ❑ etiology and pathogenesis
  - account for 10% of all stones
  - contribute to formation of staghorn calculi
  - consist of triple phosphate (calcium, magnesium, ammonium)
  - due to infection with urea splitting organisms  
 $\text{NH}_2\text{CONH}_2 + \text{H}_2\text{O} \longrightarrow 2\text{NH}_3 + \text{CO}_2$
  - $\text{NH}_4$  alkalizes urine, thus decreasing solubility
- ❑ common organisms
  - *Proteus*
  - *Klebsiella*
  - *Pseudomonas*
  - *Providencia*
  - *S. aureus*
  - not *E. coli*
- ❑ treatment
  - complete stone clearance (ESWL/percutaneous nephrolithotomy)
  - acidify urine, dissolve microscopic fragments
  - antibiotics for 6 weeks
  - follow up urine cultures

**Uric Acid Stones**

- ❑ account for 10% of all stones
- ❑ description and diagnosis
  - orange coloured gravel, needle shaped crystals
  - radiolucent on x-ray
  - filling defect on IVP
  - radiopaque on CT scan
  - visualized with ultrasound
- ❑ etiology
  - hyperuricosuria (urine pH < 5.5)
    - secondary to increased uric acid production, or drugs (ASA and probenecid)
  - hyperuricemia
    - gout
    - myeloproliferative disease
    - cytotoxic drugs
    - defect in tubular  $\text{NH}_3$  synthesis (ammonia trap for  $\text{H}^+$ )
  - dehydration, IBD, colostomy and ileostomy
- ❑ treatment
  - increase fluid intake
  - $\text{NaHCO}_3$  (maintain urinary pH no less than 6.5)
  - allopurinol
  - avoid high protein/purine diet

**Cystine Stones**

- ❑ autosomal recessive defect in small bowel mucosal absorption and renal tubular absorption of dibasic amino acids
- ❑ seen in children and young adults
- ❑ aggressive stone disease

## KIDNEY AND URETER ... CONT.

- ❑ description
  - hexagonal on urinalysis
  - yellow, hard
  - radiopaque (ground glass)
  - staghorn or multiple
  - decreased reabsorption of "COLA"
    - cystine (insoluble in urine); ornithine, lysine, arginine (soluble in urine)
- ❑ diagnosis
  - amino acid chromatography of urine → see COLA in urine
  - serum cystine
  - Na<sup>+</sup> nitroprusside test
- ❑ treatment
  - greatly increase water intake → 3-4 L urine/day
  - HCO<sub>3</sub><sup>-</sup>
  - decrease dietary protein → methionine
  - penicillamine chelators → 2 g daily, soluble complex formed; use cautiously
  - α-mercaptopropionylglycine (MPG) → similar action to penicillamine, less toxic
  - captopril (binds cystine)
  - irrigating solutions: N-acetylcystine (binds cystine), Tromethamine-E

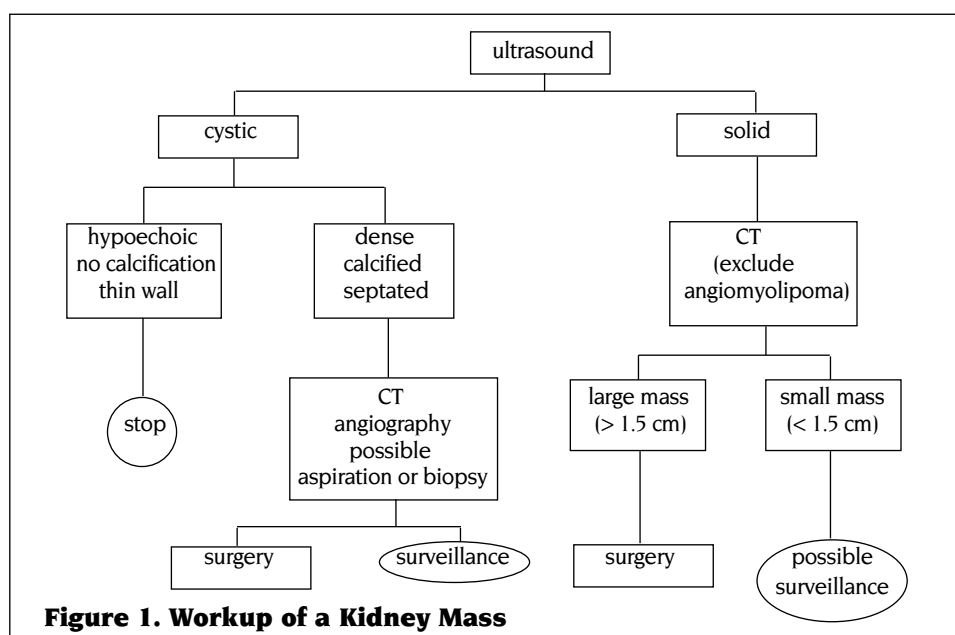


**Figure 1. Workup of a Kidney Mass**

## BENIGN RENAL TUMOURS

### Angiomyolipoma (Renal Hamartoma)

- ❑ rare benign tumour (less than 0.5% of all renal tumours)
- ❑ round, oval, expansible
- ❑ characterized by 3 major histologic components: blood vessels, smooth muscle and fat cells
- ❑ many asymptomatic, may spontaneously rupture, especially in pregnant females
- ❑ found in approximately 45-80% of patients with tuberous sclerosis (Bourneville's disease)
  - which is characterized by
    - epilepsy
    - mental retardation
    - sebaceous adenoma
    - hamartomas of brain and kidney
- ❑ diagnose by CT → fat (negative density on CT) observed in kidneys is pathognomonic for angiomyolipoma

### Renal Oncocytoma

- ❑ epithelial neoplasm of intercalated cells of collecting duct
- ❑ rarely metastasizes
- ❑ 3-7% of solid renal masses
- ❑ 80% are asymptomatic, found incidentally
- ❑ others discovered because of hematuria, palpable mass, or flank/abdominal pain

### Renal Adenoma

- ❑ small, well differentiated glandular tumours of renal cortex
- ❑ commonly found incidentally at autopsy or after nephrectomy for an unrelated disease
- ❑ 10-20% of the population
- ❑ asymptomatic
- ❑ need tissue diagnosis to definitively differentiate from renal cell carcinoma

**MALIGNANT RENAL TUMOURS****Renal Adenocarcinoma (Renal Cell Carcinoma, RCC)**

- ☐ also known as hypernephroma
- ☐ eighth most common malignancy (accounts for 3% of all newly diagnosed cancers)
- ☐ 85% of primary malignant tumours in kidney
- ☐ male:female = 3:1
  - peak incidence at 50-60 years of age
- ☐ called the "internist's tumour" because of paraneoplastic symptomatology
- ☐ etiology
  - cause is unknown
  - originates from proximal convoluted tubule epithelial cell
  - histologically divided: clear, granular, and spindle cell types
  - risk factors: smoking (results in 2x increased relative risk), cadmium exposure, employment in leather industry
  - familial incidence seen with von Hippel Lindau syndrome which is characterized by
    - RCC (present in 2/3), usually bilaterally
    - headache, ataxia, and blindness due to cystic lesions of cerebellum, retinal vessel aneurysms, and tumours or cysts of the pancreas
- ☐ symptoms and signs
  - increasingly diagnosed incidentally with U/S and CT
  - poor prognostic indicators: weight loss, weakness, anemia, bone pain
  - classic triad (too late triad!) found in 10-15%
    - gross hematuria 50%
    - flank pain < 50%
    - palpable mass < 30%
  - 30% have metastases when first seen
  - paraneoplastic syndromes (10-40% of patients)
    - hematopoietic disturbances: anemia, polycythemia; raised ESR
    - endocrinopathies: hypercalcemia, production of other hormones including erythropoietin, renin, prolactin, gonadotropins, TSH, insulin, and cortisol
  - hemodynamic alterations: systolic hypertension (due to AV shunting), peripheral edema (due to caval obstruction)
  - "Stauffer's syndrome": abnormal liver function tests, decreased WBC count, fever, areas of hepatic necrosis; reversible following removal of primary tumour
- ☐ diagnosis
  - routine labs for paraneoplastic syndromes (CBC, ESR)
  - urinalysis (60-75% have hematuria)
  - IVP
  - renal ultrasound
  - CT scan
  - angiography: no longer routinely done
- ☐ methods of spread: direct, venous, lymphatic
- ☐ staging
  - involves CT, chest x-ray, liver enzymes and functions, bone scan
  - T1: tumour less than 7 cm, confined to renal parenchyma
  - T2: tumour greater than 7cm, confined to renal parenchyma
  - T3: tumour extends into major veins or adrenal, but not beyond Gerota's fascia
  - T4: tumour extends beyond Gerota's fascia
  - N0: no regional nodes
  - N1: metastasis to a single node, less than 2 cm
  - N2: metastasis to a single node between 2 and 5 cm or multiple nodes, less than 2 cm
  - N3: node greater than 5 cm
  - M0: no evidence of metastasis
  - M1: presence of distant metastasis
- ☐ treatment
  - surgical (mainstay)
    - radical nephrectomy
    - en bloc removal of kidney, tumour, ipsilateral adrenal gland and intact Gerota's capsule and paraaortic lymphadenectomy
    - surgical removal of solitary metastasis may be considered
  - radiation for palliation
    - for painful bony lesions
  - chemotherapy: NOT effective
  - immunotherapy: investigational
- ☐ prognosis
  - stage at diagnosis is the single most important predictor of survival
  - 5 year survival of T1 is 90-100%
  - 5 year survival of T2-T3 is approximately 60%
  - 5 year survival of patients presenting with metastasis is 0-20%

### CARCINOMA OF THE RENAL PELVIS AND URETER

- ☐ incidence
  - rare, accounts for 4% of all urothelial cancers
  - frequently multifocal
  - papillary transitional cell cancer 85% (others include squamous cell, adenocarcinoma)
  - male:female = 3:1
- ☐ relative incidence
  - bladder:pelvis:ureter = 100:10:1
- ☐ predisposing factors
  - chemical exposure (industrial dyes and solvents)
  - smoking
  - analgesic abuse (acetaminophen, ASA, and phenacetin)
  - Balkan nephropathy
- ☐ symptoms and signs
  - gross painless hematuria (70-90% of patients)
  - microscopic hematuria found incidentally
  - flank pain
  - tenderness over kidney
  - flank mass caused by either tumour or associated hydronephrosis (10-20% of patients)
- ☐ diagnosis
  - made by noting a radiolucent filling defect on IVP
  - differential diagnosis of filling defect
    - transitional cell carcinoma (differentiate via cytology and CT scan)
    - uric acid stone (differentiate via cytology and CT scan)
    - blood clot
    - pyelitis cystica
    - papillary necrosis
    - fungus ball
    - gas bubble from gas producing organisms
- ☐ treatment
  - radical ureteronephrectomy with cuff of bladder
  - distal ureterectomy for distal ureteral tumours
  - overall 5 yr. survival following ureteronephrectomy is 84%

### RENAL TRAUMA

- ☐ etiology: blunt (80%, MVA, assaults, falls) vs. penetrating (20%, stab and gunshots)
- ☐ history: mechanism of injury
- ☐ P/E: ABCs, renal vascular injury → shock
  - flank contusions, lower rib/vertebral #, upper abdominal/flank tenderness suggest blunt trauma
- ☐ U/A: hematuria, (> 5 RBC/HPF), degree of hematuria does not correlate with the degree of injury
- ☐ imaging: IVP, CT if patient stable → look for renal laceration, urinary extravasation, retroperitoneal hematoma, and associated intra-abdominal organ injury
- ☐ classification according to severity
  - minor: contusions and superficial lacerations, 90% of all blunt traumas, surgical exploration seldom necessary
  - major: laceration that extends into deep medulla and collecting system, injuries to renal artery/vein and segmental branches
- ☐ management
  - microscopic hematuria + isolated well-staged minor injuries do not need hospitalization
  - gross hematuria + contusion/minor lacerations: hospitalize, bedrest, repeat CT if bleeding persists
- ☐ surgical management
  - absolute indications: hemorrhage and hemodynamic instability
  - relative indications
    - nonviable tissue and major laceration
    - urinary extravasation
    - vascular injury
    - incomplete staging
    - laparotomy for associated injury
- ☐ outcome
  - F/U with IVP or CT before discharge, and at 6 weeks
  - hypertension in 5% of renal trauma

# BLADDER

## BLADDER CARCINOMA

- ❑ epidemiology
  - male:female = 3:1
  - mean age at diagnosis is 65 years
  - second most common urologic cancer
- ❑ classification
  - transitional cell carcinoma (TCC) >90%
  - squamous cell carcinoma (SCC) 5-7%
  - adenocarcinoma 1%
  - others < 1%
- ❑ stages of transitional cell carcinoma at diagnosis
  - superficial papillary (75%) -> >80% overall survival
    - 15% of these will progress to invasive TCC
    - the majority of these patients will have recurrence
  - invasive (25%) -> 50-60% 5-year survival
    - 85% have no prior history of superficial TCC (i.e. de novo)
    - 15% have occult metastases at diagnosis
    - common sites of metastasis: lymph nodes, lung, peritoneum, liver
  - carcinoma in situ
    - may progress to invasive TCC
- ❑ risk factors
  - smoking (main factor – implicated in 60% of new cases)
  - chemicals – naphthylamines, benzidine, tryptophan metabolites
  - cyclophosphamide
  - phenacetin metabolites
  - *Schistosoma hematobium* (associated with SCC)
  - chronic irritation (cystitis, chronic catheterization, bladder stones), associated with SCC
- ❑ symptoms and signs
  - hematuria (85-90%)
  - pain (50%)
  - clot retention (17%)
  - no symptoms (20%)
  - occult hematuria
  - irritative urinary symptoms - consider carcinoma in situ
  - palpable mass on bimanual exam -> likely muscle invasion
  - hepatomegaly, lymphadenopathy if metastases
  - lower extremity lymphedema if local advancement or lymphatic spread
- ❑ investigation
  - urinalysis, urine C+S, urine cytology (sensitivity increases as grade/stage increases)
  - ultrasound
  - cystoscopy with bladder washings (gold standard)
  - new advances with specific bladder tumour markers (NMP-22, BTA, Immunocyt, FDP)
  - intravenous pyelogram (IVP)
  - for invasive disease – CT or MRI, chest x-ray, liver function tests (metastatic work-up)
- ❑ grading
  - Grade 1: Well-differentiated (10% invasive)
  - Grade 2: Moderately differentiated (50% invasive)
  - Grade 3: Poorly differentiated (80% invasive)
- ❑ TNM classification (see Figure 2)
  - Ta noninvasive papillary carcinoma
  - Tis carcinoma in situ; flat tumour
  - T1 tumour invades submucosa/lamina propria
  - T2a tumour invades superficial muscle
  - T2b tumour invades deep muscle
  - T3 tumour invades perivesical fat
  - T4a adjacent organ involvement; prostate, uterus or vagina
  - T4b adjacent organ involvement; pelvic wall or abdominal wall
  - N, M status: as for renal cell carcinoma
- ❑ treatment
  - superficial disease (Tis, Ta, T1)
    - TURBT +/- intravesical chemo-/immuno-therapy (e.g. BCG, thiotepa, mitomycin C) adjuvantly to decrease recurrence rate
  - invasive disease (T2a, T2b, T3)
    - radical cystectomy + pelvic lymphadenectomy with urinary diversion and/or irradiation
  - advanced/metastatic disease (T4a, T4b, N+, M+)
    - initial systemic chemotherapy +/- irradiation

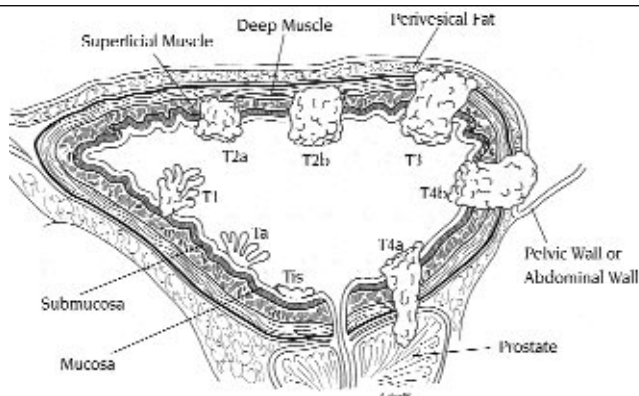


**Figure 2. Transitional Cell Carcinoma of Bladder**

Illustration by Christine Kenney

## NEUROGENIC BLADDER

### Definition

- ❑ a bladder deficient in some aspect of its innervation

### Normal Functional Features of the Bladder

- ❑ capacity of 350-500 cc
- ❑ a sensation of fullness
- ❑ ability to accommodate various volumes without a change in intravesical pressure
- ❑ ability to initiate and sustain a contraction until empty
- ❑ voluntary initiation or inhibition of voiding (despite involuntary nature of the organ)

### Innervation

- ❑ afferent
  - somatic: pudendal nerve
  - visceral: sympathetic and parasympathetic fibers (sensation of fullness)
- ❑ efferent
  - parasympathetic: S2-S4 → pelvic plexus → cholinergic postganglionic fibers → bladder + sphincter
  - sympathetic: T10-L2 → hypogastric/pelvic plexus → noradrenergic postganglionic fibers → smooth muscle of bladder base, internal sphincter, proximal urethra
  - somatic: S2-S3 → pudendal nerve → external sphincter

### Micturition Reflex Pathways

- ❑ sensory input from afferents → activation of sacral center → detrusor contraction, bladder neck opening, sphincter relaxation
- ❑ pontine center – sends either excitatory or inhibitory impulse to regulate micturition
  - coordinates detrusor contraction with simultaneous sphincter relaxation
- ❑ cerebral (suprapontine) control
  - voluntary control
  - net effect is inhibitory
- ❑ cerebellum, basal ganglia, thalamus, and hypothalamus all have input at pontine micturition center

### Classification of Neurogenic Bladder

- ❑ failure to store
  - bladder problem – detrusor hyperactivity, decreased compliance, detrusor hypersensitivity
  - outlet problem – weak urethra
- ❑ failure to empty
  - bladder problem – neurologic, myogenic, psychogenic, idiopathic
  - outlet problem – anatomic, functional (detrusor-sphincter dyssynergia)

### Hald-Bradley Neurotopographic Classification (NB: one of numerous classification systems)

- ❑ supraspinal lesion: defective inhibition of the voiding reflex → detrusor hyperreflexia with preserved sensation
- ❑ suprasacral spinal lesion: deficit depends on level of lesion; typically spasticity below level of lesion (see specific conditions below)
- ❑ infrasacral lesion: usually flaccidity
- ❑ peripheral autonomic neuropathy: deficient bladder sensation → increasing residual urine → decompensation
- ❑ muscular lesion: can involve detrusor, smooth/striated sphincter

### Neuro-urologic Evaluation

- ❑ history and physical exam (urologic and general neurologic)
- ❑ urinalysis, renal profile
- ❑ imaging: IVP, U/S → rule out hydronephrosis and stones
- ❑ cystoscopy
- ❑ urodynamic studies
  - measure pressures, flow rates during bladder filling and emptying
  - incorporates EMG

**Treatment**

- ☐ goals of treatment (in order of importance)
  - maintenance of low pressure storage and emptying system with minimum of tubes and collecting devices
  - prevent renal failure
  - prevent infections
  - prevent incontinence
- ☐ treatment options: depends on status of bladder and urethra
  - bladder hyperactivity → medications to relax bladder (see Incontinence section); occasionally augmentation cystoplasty
  - flaccid bladder → intermittent catheterization

**Detrusor External Sphincter Dyssynergia**

- ☐ contraction of bladder and external sphincter at the same time
- ☐ caused by injury between brainstem and sacral cord
- ☐ may require stents or transurethral sphincterotomy in males

**Autonomic Dysreflexia**

- ☐ syndrome of exaggerated sympathetic activity in response to a noxious stimuli (distended bladder in a para or quadriplegic) below the lesion which is usually above T6, 7
- ☐ hypertension, reflex bradycardia, sweating and vasoconstriction below lesion
- ☐ red and vasodilated above level of lesion
- ☐ treatment: remove noxious stimulus (insert a catheter), parenteral ganglionic or alpha-blockers or chlorpromazine (prophylaxis during cystoscopy)

**INCONTINENCE****Definition**

- ☐ the involuntary leakage of urine sufficiently severe to cause social or hygiene problems
- ☐ continence is dependent on:
  - 1) compliant reservoir (involuntary smooth muscle of bladder neck)
  - 2) sphincteric efficiency (voluntary striated muscle of external sphincter; intact mucosa, intact pelvic floor supports)

**Epidemiology**

- ☐ affects all ages
- ☐ more frequent in the elderly, affecting 5-15% of those living in the community and 50% of nursing home residents
- ☐ F:M = 2:1

**Classification**

- ☐ stress: urine loss with sudden increase in intra-abdominal pressure (e.g. coughing or sneezing) → usually only lose a few drops of urine
  - weakness of pelvic floor musculature (child bearing, previous abdominal/pelvic surgery)
  - damage/weakness of urethra or sphincter (eg. hypoestrogen of menopause, child bearing)
  - mechanism: proximal urethra drops below pelvic floor and transmission of increased intra-abdominal pressure is not distributed evenly; pelvic floor supports weak (bladder pressure > urethral pressure)
  - Dx by stress test
  - degrees: mild: sneezing, coughing; moderate: leaks when walking; severe: leaks when standing up
- ☐ urge: urine loss preceded by strong, unexpected urge to void
  - local bladder irritation (e.g. cystitis, stone, tumour, infection)
  - associated with inflammatory or neurogenic disorder
  - urodynamics - uninhibited contractions if unstable bladder (detrusor - hyperreflexia/instability); small bladder capacity if irritable bladder
- ☐ overflow: urine loss when intravesical pressure exceeds urethral pressure (due to retention and overdistension)
  - obstructive (e.g. BPH, stricture)
  - hypotonic bladder (e.g. DM, autonomic neuropathy, anticholinergic meds)
  - urodynamics: large bladder capacity
- ☐ total: constant or periodic loss of urine without warning
  - loss of sphincteric efficiency (previous surgery, nerve damage, cancerous infiltration)
  - abnormal connection between urinary tract and skin thereby bypassing sphincter (bladder exstrophy, epispadias, vesico-vaginal fistulae, ectopic ureteral orifices)
- ☐ functional: urine loss caused by inability to reach toilet in time
  - physical immobility

**Assessment**

- ☐ history +/- voiding diary
- ☐ physical exam: GU, DRE, neurologic
- ☐ labs: urinalysis, urine C+S, renal profile
- ☐ other investigations:
  - catheterization with post-void residuals
  - U/S
  - cystoscopy
  - VCUG
  - urodynamic studies – cystometrogram (CMG), uroflowmetry

### Management

- ☐ goals
  - improvement or cure
  - improvement in quality of life
  - low pressure system with minimal tubes and devices
- ☐ stress
  - Kegel's exercises
  - topical estrogen cream
  - injectable agents
  - surgery (cystourethropepy slings)
- ☐ urge
  - antispasmodics (oxybutinin)
  - anticholinergics (propantheline, tolterodine)
  - tricyclic antidepressants (imipramine)
- ☐ overflow
  - catheterization
  - further treatment directed at underlying cause of urinary retention
- ☐ total
  - usually surgical correction of underlying etiology or urinary diversion
- ☐ other treatments
  - pads
  - bladder training (timed voiding patterns)
  - self-stimulated voiding
  - condom drainage
  - penile clamp

### URINARY TRACT INFECTIONS

#### Definition

- ☐ greater than 100,000 bacteria/mL - midstream urine
- ☐ if symptomatic, 100 bacteria/mL may be significant

#### Classification

- ☐ first infection: first documented UTI
- ☐ unresolved bacteriuria: urinary tract is not sterilized during therapy (most commonly due to resistant organisms or noncompliance)
- ☐ bacterial persistence: urine cultures become sterile during therapy but resultant reinfection of the urine by the same organisms occur
- ☐ reinfection: new infections with new pathogens, 80% of recurrent UTIs

#### Source

- ☐ ascending (commonest) - gut organisms
- ☐ hematogenous (TB, perinephric abscess)
- ☐ lymphatic
- ☐ direct (IBD fistulas)

#### Predisposing Factors

- ☐ stasis and obstruction:
  - posterior urethral valves
  - reflux
  - residual urine
  - drugs (anticholinergics)
- ☐ foreign body:
  - catheter
  - stone
  - instrumentation
- ☐ decreased resistance:
  - diabetes mellitus
  - malignancy
  - immunosuppression
- ☐ other factors:
  - trauma
  - anatomic variance (congenital)

#### History

- ☐ irritative symptoms
- ☐ obstructive symptoms
- ☐ previous UTIs
- ☐ renal calculi
- ☐ sexual activity
- ☐ personal hygiene
- ☐ hematuria
- ☐ pain
- ☐ tenderness (CVA, abdominal, rectal)
- ☐ pyuria
- ☐ +/- fever, chills, nausea, vomiting
- ☐ sepsis/shock

**Organisms**

- ☐ routine cultures, mnemonic “**KEEPS**”
  - **K**lebsiella
  - **E.** coli (90%), other Gram negatives
  - **E**nterococci
  - **P**roteus mirabilis, **P**seudomonas
  - **S.** saprophyticus, **S.** fecalis
- ☐ non-routine cultures
  - TB
  - Chlamydia
  - Mycoplasma (Ureaplasma urealyticum)
  - fungi (Candida)

**Indications for Investigations**

- ☐ persistence of pyuria/symptoms after adequate therapy
- ☐ severe infection with an increase in creatinine
- ☐ hematuria
- ☐ recurrent/persistent infections
- ☐ any male
- ☐ infection in children (see Pediatrics Chapter)

**Investigations**

- ☐ midstream urine R&M, C&S (routine)
- ☐ urine cytology (if indicated)
- ☐ IVP/ultrasound (if indicated)
- ☐ cystoscopy (if indicated)
- ☐ spiral CT (if indicated)
- ☐ voiding cystourethrogram (VCUG) if recurrent and/or hydronephrosis

**Treatment**

- ☐ confirm diagnosis
- ☐ establish predisposing cause (if any) and correct
- ☐ identify organism and treat (TMP/SMX, fluoroquinolones, nitrofurantoin)
- ☐ for mild infections 3 day course is sufficient
- ☐ consider self administered antibiotics
- ☐ consider long term, low dose prophylaxis
- ☐ if febrile, consider admission with IV therapy and rule out obstruction

**RECURRENT/CHRONIC CYSTITIS**

- ☐ incidence of bacteriuria in females
  - pre-teens: 1%; late teens: 4%; 30-50 years: 6%
- ☐ can be caused by perineal colonization in females
- ☐ investigations include IVP, cystoscopy, ultrasound
- ☐ relation to intercourse (postcoital antibiotics?)
- ☐ prophylaxis if greater than three or four attacks per year (long term low dose antibiotics)
- ☐ self-administered antibiotics

**INTERSTITIAL CYSTITIS**

- ☐ epidemiology
  - prevalence: ~20/100,000
  - 90% of cases are in females
  - mean age at onset is 40 years
  - higher prevalence in Jews
- ☐ etiology: unknown
  - theories: increased epithelial permeability; autoimmune; neurogenic
  - associations: severe allergies; IBS, fibromyalgia
- ☐ classification
  - non-ulcerative (more common) - younger to middle-aged
  - ulcerative – middle-aged to older
- ☐ diagnosis (not usually adhered to)
  - NIDDK required criteria
    - 1) glomerulations (submucosal petechiae) or Hunner's ulcers on cystoscopic examination, AND
    - 2) pain associated with the bladder or urinary urgency
- ☐ differential diagnoses
  - UTI
  - vaginitis
  - bladder tumour
  - radiation/ chemical cystitis
  - eosinophilic/TB cystitis
  - bladder calculi
- ☐ treatment
  - symptomatic only (no cure)
  - bladder hydrodistension (also diagnostic)
  - intravesical dimethylsulfoxide (DMSO), cystistat, heparin
  - intravesical hyaluronic acid or heparin
  - amitriptyline
  - pentosan polysulfate (Elmiron)
  - TENS, acupuncture
  - surgery is last resort

**BLADDER STONES**

- ☐ etiology
  - males > females
  - stasis (bladder outflow obstruction)
  - foreign body
- ☐ description
  - usually large, single stone
  - multiple if associated with retained urine or bladder diverticula
- ☐ signs and symptoms
  - frequency and urgency
  - intermittent terminal dysuria
  - pyuria
  - terminal hematuria
  - obstructive symptoms
  - suprapubic pain
- ☐ stone types
  - calcium oxalate/phosphate
  - struvite (infected urine)
  - uric acid
- ☐ investigations
  - KUB (uric acid stones not seen)
  - U/S
  - cystoscopy (gold standard)
- ☐ treatment
  - transurethral litholapaxy
  - remove outflow obstruction (TURP or dilatation of stricture)
  - bladder irrigation with dissolution agents

**URINARY RETENTION****Etiology**

- ☐ outflow obstruction
  - BPH
  - prostate cancer
  - prostatitis
  - meatal or urethral stricture
  - calculus/clot at bladder neck
  - urethral disruption due to trauma
  - bladder or urethral foreign body
- ☐ loss of bladder innervation
  - disk herniation
  - spinal cord injury
  - stroke
  - DM
  - post-pelvic surgery
- ☐ pharmacological
  - major tranquilizers
  - anticholinergics
  - narcotics
  - antihypertensives (ganglionic blockers, methyl dopa)

**History and Physical**

- ☐ vitals
- ☐ palpable and/or percussable bladder in lower abdomen
- ☐ possible purulent/bloody meatal discharge
- ☐ DRE (size of prostate + anal tone)
- ☐ neurological: deep tendon reflexes, "anal wink", normal sensation

**Investigations**

- ☐ CBC, lytes, Cr, BUN, urine R&M, C&S, ultrasound, and possibly cystoscopy

**Management**

- ☐ catheterization (use least invasive technique possible)
  - urethral anesthetic lubricant, 16-18 Fr Foley catheter (if this fails, try a coude tip catheter if patient has BPH)
  - rarely filiform and followers (in difficult cases, may need cystourethroscopy to guide filiform) or percutaneous suprapubic cystostomy
  - catheterization is contraindicated in trauma patient unless urethral disruption has been ruled out
  - watch for post-obstructive diuresis after catheterization:
    - marked polyuria after relief of obstruction
    - can be physiologic (caused by retained urea, sodium and water) or pathologic (caused by impairment of concentrating ability or sodium reabsorption)
- ☐ in post-operative patients
  - encourage ambulation
  - cholinergics to cause bladder contraction (occasionally)
  - alpha-blockers to relax bladder neck
- ☐ definitive treatment will depend on etiology

**BLADDER TRAUMA**

- ☐ blunt (MVA, falls, and crush injury) vs. penetrating trauma to lower abdomen, pelvis, or perineum
- ☐ blunt is associated with pelvic # in 97% of cases

**History and Physical**

- ☐ abdominal tenderness and distension, and unable to void
- ☐ may be few peritoneal signs or symptoms
- ☐ associated injuries such as pelvic and long bone # are common
- ☐ hemodynamic instability also common due to extensive blood loss in the pelvis

**Investigations**

- ☐ U/A: gross hematuria in 95% of bladder ruptures

**Imaging**

- ☐ cystogram (extravasation), CT cystogram

**Classification**

- ☐ contusions: no urinary extravasation, damage to mucosa or muscularis
- ☐ intraperitoneal ruptures: often involve the dome
- ☐ extraperitoneal ruptures: involve anterior or lateral bladder wall

**Management**

- ☐ depends on the type of bladder injury and the extent of associated injuries
- ☐ contusion: urethral catheter until hematuria completely resolves
- ☐ extraperitoneal bladder perforations can be managed non-operatively if associated injuries do not require a laparotomy and the urine is sterile at time of the injury
  - others will need surgical management
- ☐ intraperitoneal injuries require drainage and a suprapubic catheter

**Complications**

- ☐ mortality is around 20%, and is usually due to associated injuries due to trauma rather than bladder rupture
- ☐ complications of bladder injury itself are rare

**BLADDER CATHETERIZATION**

- ☐ catheter size referred to in terms of the French (Fr) scale
- ☐ No.1 Fr = 0.33 mm in diameter; each 1 mm in diameter = approximately 13 Fr

**1) Continuous catheterization**

- ☐ indications
  - accurate monitoring of urine output
  - relief of urinary retention due to medication, neurogenic bladder or infravesical obstruction
  - temporary therapy for urinary incontinence
  - perineal wounds
  - clot removal (24-28 Fr)
  - post-operation

**2) Intermittent catheterization**

- ☐ indications
  - to determine post-void residual volumes
  - to obtain sterile diagnostic specimens for urinalysis/cultures
  - management of neurogenic bladder or chronic urinary retention
- ☐ difficult catheterizations
  - meatal stricture
  - urethral stricture
  - BPH
  - urethral disruption/obstruction
  - anxious patient
- ☐ solutions
  - sufficient lubrication
  - xylocaine jelly (abort if resistance -> reports of fat emboli)
  - anxiolytic medication
  - different size catheter
  - dilation of strictures
  - coude or filiform catheter

# PROSTATE

## Functions of the Prostate (are primarily exocrine and mechanical in nature)

- ☐ zinc (a component of prostatic fluid) has potent bactericidal properties
- ☐ prostatic fluid alkalinizes semen and therefore protects sperm in the acidic environment of the vagina
- ☐ prevents the seminal fluid from coagulating and therefore increases sperm motility and fertility
- ☐ smooth muscle fibres of the prostate help maintain continence

## BENIGN PROSTATIC HYPERPLASIA (BPH)

### Features

- ☐ age-related, extremely common (50% of 50 year olds, 80% of 80 year olds)
- ☐ 25% of men will require treatment
- ☐ etiology unknown (androgens required)
- ☐ hyperplasia in periurethral area of prostate (transition zone)
- ☐ composed of varying amount of stroma and epithelium

### Signs and Symptoms

- ☐ obstructive (mechanical and/or dynamic)
- ☐ irritative symptoms secondary to outlet resistance
  - infection
  - bladder instability (overactive detrusor)
  - acute retention
- ☐ prostate is smooth, rubbery and symmetrically enlarged on DRE; prostate size does not correlate with symptoms
- ☐ silent prostatism
  - incontinence
  - decompensated bladder
  - secondary renal insufficiency

### Workup

- ☐ history
  - self-administered questionnaires developed to follow progression of disease and response to therapy
  - WHO Symptom Score Assessment; American Urology Association Symptom Score with Quality of Life Score; International Prostate Symptom Score with Quality of Life Score
- ☐ DRE
- ☐ urinalysis to exclude UTI
- ☐ creatinine to assess renal function
- ☐ PSA to rule out malignancy (if life expectancy > 10 years)
- ☐ uroflowmetry to measure flow rate (optional)
- ☐ bladder ultrasound to determine post-void residual urine (optional)
- ☐ cystoscopy for potential surgical management

### Treatment

- ☐ conservative for those with mild symptoms
  - watchful waiting
  - 50% of patients improve spontaneously
  - includes lifestyle changes e.g. evening fluid restriction, planned activities
- ☐ medical treatment
  - $\alpha$ -adrenergic antagonists to reduce stromal smooth muscle tone (e.g. terazosin (Hytrin), doxazosin (Cardura), tamsulosin (Flomax))
  - finasteride is a 5- $\alpha$  reductase inhibitor that blocks the conversion of testosterone to dihydrotestosterone; acts on the epithelial component of the prostate; improves symptoms if prostatic size is > 40 cc
- ☐ absolute indications for surgery
  - refractory urinary retention
  - recurrent UTIs
  - recurrent gross hematuria
  - bladder stones
  - large bladder diverticulum
  - renal insufficiency
- ☐ transurethral resection of prostate (TURP)
  - > 95% of prostatectomies
  - 80-90% have improvement in symptoms with increase in flow by 100%
  - in 20%, it does not relieve irritative symptoms
  - complications
    - retrograde ejaculation (75%)
    - impotence (10%)
    - incontinence (1%)
    - approximately 5% will require reTURP within 5-10 years
- ☐ open prostatectomy  $\rightarrow$  5% of surgery
  - for large prostates or associated problems (e.g. bladder stones)
  - suprapubic (transvesically to deal with bladder pathology)
  - retropubic (through the prostatic capsule)
- ☐ minimally invasive therapy
  - stents, microwave therapy, laser ablation, cryotherapy, high intensity focused ultrasound (HIFU) and transurethral needle ablation (TUNA)

**PROSTATE SPECIFIC ANTIGEN (PSA)**

- ☐ enzyme produced by epithelial cells of prostate gland to liquify the ejaculate
- ☐ leaks into circulation and is present at < 4 ng/mL
- ☐ measured total serum PSA is a combination of free (unbound) PSA (15%) and complexed PSA (85%)

**Screening and Investigation for Prostate Cancer: PSA, DRE, and TRUS**

(Ontario Ministry of Health and Long-Term Care - Ontario PSA Clinical Guidelines, 2000)

- ☐ PSA is specific to the prostate, but is NOT specific for prostate cancer
- ☐ PSA may also be increased in: BPH, prostatitis, prostatic ischemia/infarction, acute urinary retention, prostate biopsy/surgery, prostatic massage, Foley catheterization, TRUS, strenuous exercise, ejaculation, ARF, CABG, radiation therapy
- ☐ in the past, PSA of > 4.0ng/ml has been considered "abnormal", but age-related norms have been suggested

| Age Range (years) | Serum PSA Concentration (g/L) |
|-------------------|-------------------------------|
| 40-49             | < 2.5                         |
| 50-59             | < 3.5                         |
| 60-69             | < 4.5                         |
| 70-79             | < 6.5                         |

Oesterling JE et al. JAMA. 1993; 270-860.

- ☐ PSA should NOT be used for population-wide screening in asymptomatic men for the early detection of prostate cancer. Why?
  - PSA is poorly specific for prostate cancer and is therefore fraught with false-positive results
  - many prostate tumors are slow-growing and those with life-expectancies less than 10 years will often die of other causes
  - knowing the result of a PSA test necessitates a treatment decision which include surgery and/or radiation, both of which have a spectre of life-long risks and complications (e.g. erectile dysfunction, incontinence)
  - PSA alone in screening asymptomatic men for cancer has not been shown to decrease mortality
  - therefore, screening/investigation/diagnosis of prostate cancer must use additional investigational techniques
- ☐ DRE
  - a part of routine medical care, but also poorly sensitive
  - only posterior and lateral aspects palpable and 40% of tumours occur anterior to prostate midline and, stage A tumours are not palpable by definition
  - like PSA, no evidence that screening with DRE alone is useful
- ☐ TRUS
  - good for determining prostate volume and can detect suspicious areas (cancerous areas are frequently, but not always, hypoechoic), but is not an alternative to DRE and its sensitivity is also poor
- ☐ PSA, DRE and TRUS must therefore be used in conjunction for screening and investigation
- ☐ thus, PSA can be used for the investigation / diagnosis of prostate cancer in patients with a life expectancy of >10 years and who
  - are found to have a prostatic nodule on DRE, or
  - have an increased suspicion of prostate cancer (abnormal feeling prostate, focal lesion, discrete change in texture, fullness or symmetry), or
  - when there is secondary carcinoma of unknown origin, or
  - when moderate or severe symptoms of prostatism (AUA Symptom Index Score of  $\geq 8$ ) are present in a patient who is contemplating treatment
- ☐ for investigation, if either PSA or DRE are mildly abnormal (PSA<10)
  - then, do 1) TRUS, and/or 2) repeat PSA+TRUS in 12 months, and/or
  - do 3) PSA density, and/or do 4) free/total PSA ratio, and/or 5) biopsy
- ☐ if both PSA and DRE mildly abnormal, or if PSA abnormal (>10), or if DRE moderately/highly suspicious
  - do TRUS-guided biopsy immediately
- ☐ as PSA testing for screening purposes in asymptomatic males is not insured in Ontario, the Ministry advocates informed choice for patients: the test is available given that the patient understands its risks and implications
- ☐ for monitoring those with established cancer (based on positive biopsy)
  - if watchful waiting: repeat PSA every 6-12 months
  - if determining effect of therapy or early occurrence: DRE + PSA (level will depend on treatment used)
  - t<sub>1/2</sub> = 2-3 days, must wait 2-3 weeks after transient increase to re-test
- ☐ strategies to increase specificity of PSA test
  - PSA velocity
    - PSA change divided by time - measured over a 2 year period
    - > 0.75 ng/mL/year associated with increased risk of cancer
  - PSA density
    - PSA divided by prostate volume as found on TRUS
    - > 0.15 ng/mL/g associated with increased risk of cancer
  - age adjusted PSA reference ranges
    - free-to-total PSA ratio
  - complexed PSA increases in prostate cancer, decreasing the percentage of the free fraction
  - < 25% free PSA cutoff would detect 95% of cancers and increase specificity by 20% associated with increased risk of cancer

**PROSTATIC CARCINOMA (CaP)****Incidence**

- ☐ most prevalent cancer in males
- ☐ second leading cause of male cancer deaths
- ☐ lifetime risk of a 50 y.o. man for CaP is 50%, and risk of death is 3%

**Risk Factors**

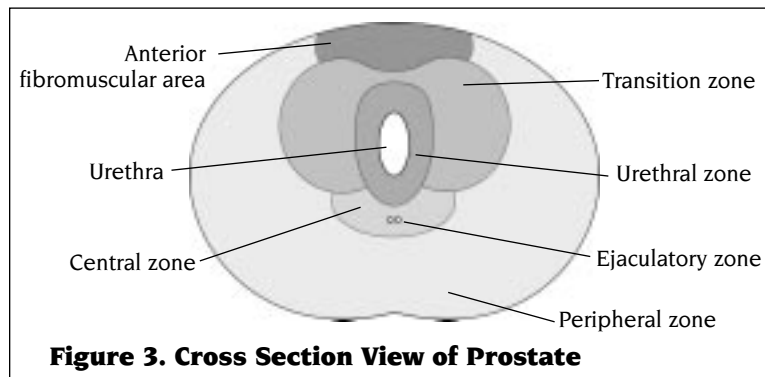
- ☐ not known (but requires testes as disease is not present in eunuchs)
- ☐ urban blacks have increased incidence
- ☐ family history
  - 1st degree relative = 2x risk
  - 1st and 2nd degree relatives = 9x risk
- ☐ high dietary fat increases risk by 2x

**Pathology**

- ☐ adenocarcinoma
  - > 95%
  - often multifocal
- ☐ transitional cell carcinoma (4.5%)
  - associated with TCC of bladder
  - not hormone-responsive
- ☐ endometrial (rare)
  - carcinoma of the utricule

**Anatomy (see Figure 3)**

- ☐ 60-70% of nodules arise in the peripheral zone
- ☐ 10-20% arise in the transition zone
- ☐ 5-10% arise in the central zone

**Figure 3. Cross Section View of Prostate***Illustration by Meaghan Brierley***Methods of Spread**

- ☐ local invasion
- ☐ lymphatic spread to regional nodes
  - obturator > iliac > presacral/para-aortic
- ☐ hematogenous dissemination occurs early
- ☐ bony metastasis to axial skeleton is very common (osteoblastic)
- ☐ soft tissue metastasis is less common with liver, lung and adrenal metastases occurring most frequently
- ☐ obstructive and irritative symptoms uncommon without spread
- ☐ suspect with prostatism, incontinence +/- back pain
- ☐ hard irregular nodule or diffuse dense induration involving one or both lobes is noted on DRE
- ☐ differential diagnosis of a prostatic nodule
  - prostate cancer (30%)
  - benign prostatic hyperplasia
  - prostatitis
  - prostatic infarct
  - prostatic calculus
  - tuberculous prostatitis

**Diagnosis**

- ☐ digital rectal exam (DRE)
- ☐ PSA (prostate specific antigen) elevated in the majority of patients with CaP (see PSA section)
- ☐ transrectal ultrasound (TRUS) —> size and local staging
- ☐ TRUS-guided needle biopsy
- ☐ incidental finding on TURP
- ☐ bone scan may be omitted in untreated CaP with PSA < 10 ng/ml
- ☐ lymphangiogram and CT scanning to assess metastases

**Staging (TNM 1997)**

- ☐ T1: clinically undetectable tumour, normal DRE and TRUS
- ☐ T2: confined to prostate
- ☐ T3: tumour extends through prostate capsule
- ☐ T4: tumour invades adjacent structures (besides seminal vesicles)
- ☐ N: spread to regional lymph nodes
- ☐ M: distant metastasis
- ☐ tumour grade (Gleason score out of 10) is also important
  - 1-4 = well differentiated
  - 5-6 = moderately differentiated
  - 8-10 = poorly differentiated

## Treatment

- ☐ T1 (small well-differentiated CaP are associated with slow growth rate)
  - if young consider radical prostatectomy, brachytherapy or radiation
  - follow in older population (cancer death rate up to 10%)
- ☐ T2
  - radical prostatectomy or radiation (70-85% survival at 10 years) or brachytherapy
- ☐ T3, T4
  - staging lymphadenectomy and radiation or hormonal treatment
- ☐ N > 0 or M > 0
  - requires hormonal therapy/palliative radiotherapy to metastasis
  - bilateral orchiectomy - removes 90% of testosterone
  - LHRH agonists (e.g. leuprolide (Lupron), goserelin (Zoladex))
    - initially stimulates LH, increasing testosterone and causing "flare"
    - later causing low testosterone
    - side effects include "hot flashes"
  - estrogens (e.g. DES)
    - inhibits LH, and cytotoxic effect on tumour cells
    - increase risk of cardiovascular side effects
  - antiandrogens
    - steroidal (e.g. cyproterone acetate) and non-steroidal (e.g. flutamide) both compete with dihydrotestosterone (DHT) for cytosolic receptors
    - testosterone levels do not decrease (and may increase), so potency may be preserved
    - inhibitors of steroidogenesis (e.g. ketoconazole, spironolactone)
      - block multiple enzymes in the steroid pathway, including adrenal androgens
    - greater androgen blockade can be achieved by combining an antiandrogen with LHRH agonist or orchiectomy
    - local irradiation of painful secondaries or half-body irradiation

## Prognosis

- ☐ Stage T1-T2: excellent, compatible with normal life expectancy
- ☐ Stage T3-T4: 40-70 % survival at 10 years
- ☐ Stage N+ and/or M+: 40% survival at 5 years
- ☐ prognostic factors: tumour stage, tumour grade, PSA value

## PROSTATITIS/PROSTATODYNIA

- ☐ most common urologic diagnosis in men < 50
- ☐ incidence 10-30%

## Signs and Symptoms

**Table 1. NIDDK Categorization and Criteria for the Prostatitis Syndromes**

| NIDDK Classification                               | Criteria                                                                                 |
|----------------------------------------------------|------------------------------------------------------------------------------------------|
| Category I: Acute bacterial prostatitis            | Acute, symptomatic bacterial infection                                                   |
| Category II: Chronic bacterial prostatitis         | Recurrent prostate infection                                                             |
| Category III: Chronic pelvic pain syndrome         | No clearly identifiable infection                                                        |
| Category IIIB: Inflammatory type                   | Leukocytes present in prostatic fluid (>10/HPF)                                          |
| Category IIIB Noninflammatory type                 | No leukocytes in prostatic fluid (<10/HPF)                                               |
| Category IV: Asymptomatic inflammatory prostatitis | No subjective symptoms; detected incidentally on biopsy or examination of prostate fluid |

NIDDK = National Institute of Diabetes and Digestive and Kidney Diseases.

## Acute Bacterial Prostatitis

- ☐ etiology
  - KEEPS: *Klebsiella*, *E. coli* (80%), *Enterococci*, *Pseudomonas*, *Proteus*, *S. fecalis*
  - ascending urethral infection and reflux into prostatic ducts
  - invasion of rectal bacteria
  - most infections occur in the peripheral zone
- ☐ features
  - rectal, low back and perineal pain
  - urinary irritative symptoms
  - systemic symptoms: myalgia, arthralgia, fevers, chills
  - hematuria

## PROSTATE ... CONT.

- ❑ diagnosis
  - rectal exam
    - enlarged, tender, warm prostate
    - prostatic massage is not recommended due to extreme tenderness and risk of inducing sepsis, abscess or epididymo-orchitis
  - urine R&M, C&S
  - blood CBC, C&S
  - rule out urinary retention
- ❑ treatment
  - PO antibiotics (Cipro, Septra)
    - treat for 4-6 wks to prevent complications
  - supportive measures (antipyretics, analgesics, stool softeners)
  - admission criteria: sepsis, urinary retention, immunodeficiency
  - IV antibiotics (ampicillin and gentamicin); VB2 urine C&S 1 and 3 months post-antibiotic therapy to R/O chronic prostatitis

### Chronic Bacterial Prostatitis

- ❑ similar etiology to acute prostatitis
- ❑ features
  - recurrent exacerbations of acute prostatitis signs and symptoms
  - recurrent UTIs
  - frequently asymptomatic with normal prostate on DRE
- ❑ diagnosis
  - split urines for C&S to determine site of infection; collect 4 specimens (see Figure 4)
  - colony counts in expressed prostatic secretions (EPS) and VB3 should exceed those of VB1 and VB2 by 10-fold
- ❑ treatment
  - prolonged course of antibiotics (3-4 months)
  - fluoroquinolones, TMP/SMX or doxycycline; addition of an  $\alpha$ -blocker reduces symptoms
  - a few patients may be candidates for curative surgical therapy

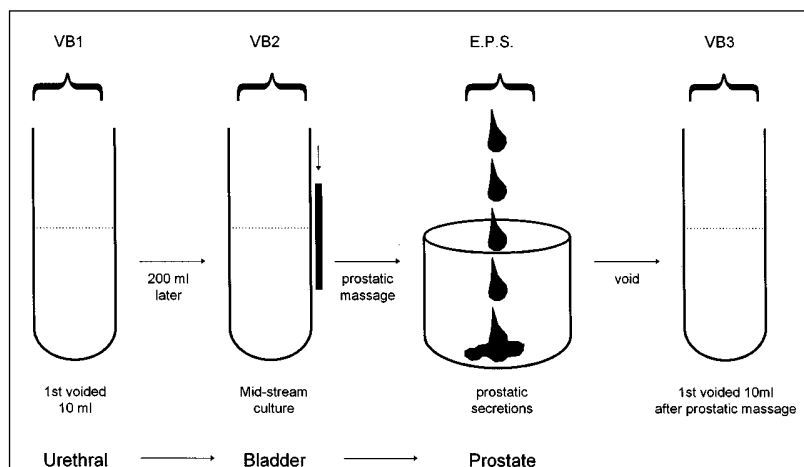


**Figure 4. Urine Specimens for Localizing Site of Infection**

### Chronic Pelvic Pain Syndrome

- ❑ inflammatory type previously called nonbacterial prostatitis
- ❑ noninflammatory type previously called prostatodynia
- ❑ most common of the prostatic syndromes and most poorly understood
- ❑ *Chlamydia*, ureaplasma and mycoplasma may be culprits
- ❑ autoimmune inflammatory reaction  $\pm$  intraprostatic reflux of urine  $\pm$  urethral hypertonia
- ❑ similar symptoms as chronic bacterial prostatitis
- ❑ treatment
  - trial of antibiotic therapy
  - fluoroquinolone or doxycycline if chlamydia is suspected
  - $\alpha$ -adrenergic blocker (e.g. prazosin) to relieve sphincter spasms and symptoms
  - NSAIDs may provide symptomatic relief

# SCROTUM AND CONTENTS

**Table 2. Classification of Painful vs. Painless Scrotal Swelling**

| Painful                         | Painless                    |
|---------------------------------|-----------------------------|
| 1. Epididymitis                 | 1. Hydrocele                |
| 2. Orchitis                     | 2. Spermatocele             |
| 3. Torsion                      | 3. Varicocele               |
| 4. Tumour (hemorrhagic)         | 4. Tumour (non-hemorrhagic) |
| 5. Hematocele                   | 5. Hernia                   |
| 6. Strangulated Indirect Hernia |                             |

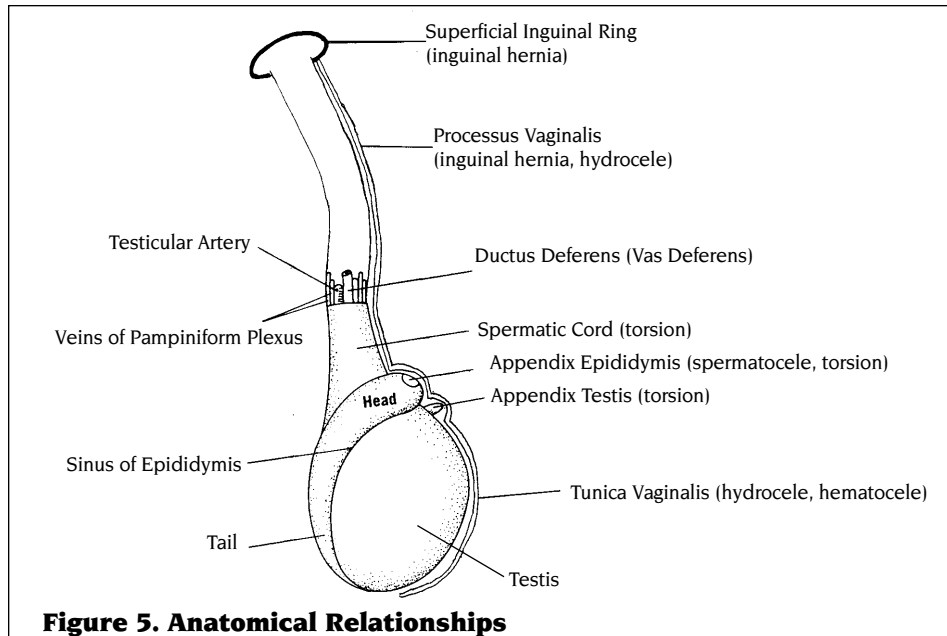


**Figure 5. Anatomical Relationships**

Reprinted with permission from O'Rahilly, R. Basic Human Anatomy. c 1983.

## EPIDIDYMITIS

### etiology

- infection
  - < 35 years - gonorrhea or *Chlamydia* (STDs)
  - > 35 years - coliforms (from GI tract)
- prior instrumentation
- reflux
  - increased pressure in prostatic urethra (straining, voiding, heavy lifting) causes reflux of urine along vas deferens → sterile epididymitis

### signs and symptoms

- sudden onset scrotal pain and swelling +/- radiation along cord to flank
- scrotal erythema and tenderness
- fever
- irritative voiding symptoms
- reactive hydrocele, epididymo-orchitis

### diagnosis

- urinalysis (pyuria), urine C&S
- +/- urethral discharge: Gram stain for gram-negative cocci or rods
- pain may be relieved with elevation of testicles (Prehn's sign), absent in testicular torsion
- if diagnosis clinically uncertain, must do
  - colour-flow Doppler ultrasound
  - nuclear medicine scan
  - examination under anesthesia (EUA)

### treatment

- antibiotics
  - GC or *Chlamydia* - ceftriaxone 250 mg IM once followed by doxycycline 100 mg BID x 21 days
  - coliforms - broad spectrum antibiotics x 2 weeks
- scrotal support, ice, analgesia

### ORCHITIS

- ❑ etiology
  - usually a result of bacterial infection (epididymo-orchitis)
  - 30% of post-pubertal males with mumps get orchitis
  - mumps orchitis usually follows parotitis by 3-4 days
  - other rare causes
    - tuberculosis (TB)
    - syphilis
    - granulomatous (autoimmune) in elderly men
- ❑ signs and symptoms
  - fever and prostration
  - +/- hydrocele
- ❑ diagnosis
  - red, swollen scrotum
  - blue testis
  - no urinary symptoms
- ❑ treatment
  - mumps hyperimmune globulin
  - analgesics, antipyretics
  - steroids
  - ice, bedrest, scrotal elevation
- ❑ complications
  - if severe, testicular atrophy
  - 30% have persistent infertility problems

### TORSION

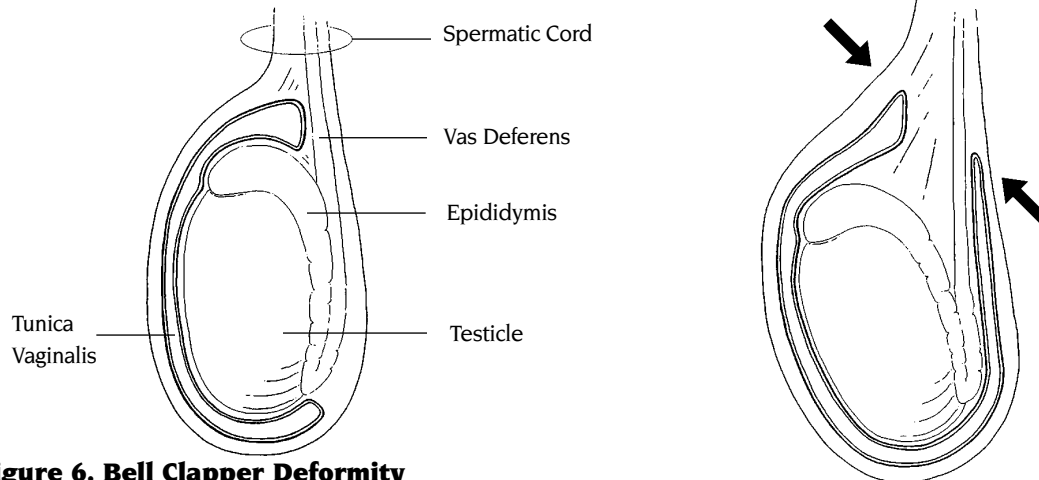
- ❑ two types: torsion of appendices or testicles

#### I. Torsion of the Appendices

- ❑ twisting of testicular/epididymal vestigial appendix
- ❑ often < 16 years of age
- ❑ signs and symptoms
  - clinically similar to testicular torsion
  - "blue dot sign" - blue infarcted appendage seen through scrotal skin (can usually be palpated as small, tender lump)
  - point tenderness over the superior-posterior portion of testicle
- ❑ treatment
  - analgesia - most will subside over 5-7 days
  - surgical exploration and excision if diagnosis uncertain or refractory pain

#### II. Testicular Torsion (spermatic cord torsion)

- ❑ testis rotate medially causing strangulation of the blood supply → ultimately leads to necrosis of entire gonad if untreated within 5-6 hours
- ❑ possible at any age, but most common in adolescence (12-18 years) due to pubertal increase in testicular volume
- ❑ incidence
  - ~1/4000, males < 25 years
- ❑ predisposing factors
  - cryptorchid testis
  - trauma (although 50% occur during sleep)
  - bell clapper congenital deformity (see Figure 6):
    - narrow mesenteric attachment from cord on to testis/epididymis → testis falls forward and is free to rotate within tunica vaginalis
  - anomalous development of tunica vaginalis or spermatic cord
- ❑ signs and symptoms
  - acute onset of severe scrotal pain, swelling +/- nausea/vomiting
  - retracted and transverse testicle (horizontal lie)
  - no pain relief with testicle elevation (negative Prehn's sign)
  - epididymis may be palpated anteriorly in the early stages
- ❑ diagnosis
  - ultrasound with colour-flow Doppler probe over testicular artery (if torsion, no blood flow)
  - decrease uptake on 99m Tc-pertechnetate scintillation scan
  - examination under anesthesia and surgical exploration
- ❑ treatment
  - emergency detorsion (rotate "outward") +/- elective bilateral orchiopexy
  - failure of manual detorsion requires surgical detorsion and bilateral orchiopexy (fixation)
  - < 12 hours - good prognosis
  - 12-24 hours - uncertain prognosis, testicular atrophy
  - > 24 hours - poor prognosis, orchiectomy is advised


**Figure 6. Bell Clapper Deformity**

*Illustrations by Brett Clayton*

**Table 3. Differential Diagnosis of Torsion vs. Epididymo-orchitis**

|                                  | <b>Torsion</b>                           | <b>Epididymo-orchitis</b>                                  |
|----------------------------------|------------------------------------------|------------------------------------------------------------|
| <b>Age</b>                       | Most common 12-18 years                  | Usually >16 years                                          |
| <b>Onset</b>                     | Acute                                    | May be gradual                                             |
| <b>Nausea</b>                    | Common                                   | None                                                       |
| <b>Fever</b>                     | 25%                                      | 30%                                                        |
| <b>Pyuria</b>                    | 20%                                      | 50%                                                        |
| <b>Scrotal Elevation</b>         | No effect                                | Decreases pain                                             |
| <b>Testicular Position</b>       | Elevated / transverse                    | Normal                                                     |
| <b>Opposite Testes</b>           | Bell clapper                             | Normal                                                     |
| <b>Colour Doppler Ultrasound</b> | Absent flow to the epididymis and testis | Increased flow to the epididymis and testis                |
| <b>Nuclear Imaging</b>           | Central photon-deficient areas           | Increased perfusion of the affected testes and hemiscrotum |
| <b>Management</b>                | surgical                                 | antibiotics, surgery if uncertain                          |

## TESTICULAR TUMOURS

- ☐ any solid testicular mass in young patient – must rule out malignancy
- ☐ slightly more common in right testis (corresponds with slightly higher incidence of right-sided cryptorchidism)
- ☐ 2-3% bilateral (simultaneously or successively)
- ☐ primary
  - 1% of all malignancies in males
  - most common solid malignancy in males aged 15-34 years
  - undescended testicle has increased risk (10-40x) of malignancy
  - 95 % are germ cell tumours (all are malignant)
    - seminoma (35%)
    - nonseminomatous germ cell tumours (NSGCT)
      - embryonal cell carcinoma (20%)
      - teratoma (5%)
      - choriocarcinoma (<1%)
      - yolk sac (<<1%)
      - mixed cell type (40%)
  - 5% are non-germinal cell tumours (usually benign)
    - Leydig (testosterone, precocious puberty)
    - Sertoli (gynecomastia, decreased libido)
- ☐ secondary
  - male > 50 years of age
  - usually a lymphoma
  - metastases (e.g. lung, prostate, GI)

## SCROTUM AND CONTENTS . . . CONT.

- ☐ etiologic factors
  - congenital: cryptorchidism
  - acquired: trauma, atrophy, sex hormones
- ☐ signs and symptoms
  - painless testicular enlargement
  - painful if intratesticular hemorrhage or infarction
  - firm, non-tender mass
  - dull, heavy ache in lower abdomen, anal area or scrotum
  - associated hydrocele in 10%
  - coincidental trauma in 10%
  - infertility (rarely presenting complaint)
  - gynecomastia due to secretory tumour effects
  - metastatic disease related back pain
  - supraclavicular and inguinal nodes
  - abdominal mass (retroperitoneal lymph node metastases)
- ☐ investigations
  - testicular ultrasound (hypoechoic area within tunica albuginea = high suspicion of testicular cancer)
  - chest x-ray (lung metastases)
  - markers for staging ( $\beta$ hCG, AFP, LDH)
  - CT abdomen/pelvis (retroperitoneal nodes enlarged)
  - needle aspiration contraindicated
- ☐ diagnosis is established by inguinal orchiectomy
- ☐ staging
  - clinical
    - Stage I: disease limited to testis, epididymis or spermatic cord
    - Stage II: disease limited to the retroperitoneal nodes
    - Stage III: disease metastatic to supradiaphragmatic nodal or visceral sites
  - pathologic (at orchiectomy)
    - T1 – tumour confined to testicular body
    - T2 – tumour extends beyond tunica albuginea
    - T3 – tumour involves rete testis/epididymis
    - T4A – tumour invades spermatic cord
    - T4B – tumour invades scrotal wall
  - ‘cross-over’ metastases from right to left are fairly common, but they have not been reported from left to right
  - right  $\rightarrow$  medial, paracaval, anterior and lateral nodes
  - left  $\rightarrow$  left lateral and anterior paraaortic nodes
- ☐ tumour markers
  - $\beta$ hCG and AFP are positive in 85% of non-seminomatous tumours
  - pre-orchiectomy elevated marker levels return to normal post-operatively if no secondaries
  - $\beta$ hCG positive in 7% of seminomas, AFP never elevated with seminoma
- ☐ treatment
  - avoid a trans-scrotal approach for biopsy or orchiectomy, due to chance of metastases via lymph drainage
  - seminoma
    - radical inguinal orchiectomy and radiation (90% survival)
    - adjuvant chemotherapy for metastatic disease
  - non-seminoma
    - radical inguinal orchiectomy and staging
    - retroperitoneal lymphadenectomy or surveillance
    - surveillance includes monitoring CXR,  $\beta$ hCG, and AFP levels
    - chemotherapy if evidence of secondary disease
- ☐ prognosis
  - 99% cured with Stage I, Stage II
  - 70-80% complete remission with advanced disease

### Clinical Pearl

- ☐ **Surgical descent of undescended testis does not reduce the risk of malignancy (10-40 x).**

### HEMATOCELE

- ☐ trauma with bleed into tunica vaginalis
- ☐ ultrasound helpful to exclude fracture of testis which requires surgical repair
- ☐ treatment: ice packs, analgesics, surgical repair

## HYDROCELE

- ❑ definition
  - collection of fluid within the tunica vaginalis
  - may occur within the spermatic cord, most often seen surrounding the testis
- ❑ etiology
  - usually idiopathic
  - found in 5-10% of testicular tumours
  - associated with trauma, orchitis, epididymitis
- ❑ types
  - communicating hydrocele: patent processus vaginalis (a form of indirect inguinal hernia)
  - non-communicating hydrocele: processus vaginalis is not patent
- ❑ diagnosis
  - usually a non-tender cystic intrascrotal mass which transilluminates
  - ultrasound (definitive), especially if < 40 years of age (rule out tumour)
- ❑ treatment
  - nothing if tolerated and no complications
  - surgical
- ❑ complications
  - hemorrhage into hydrocele sac following trauma
  - compression of testicular blood supply

## SPERMATOCELE/EPIDIDYMAL CYST

- ❑ definition
  - collection of sperm in the appendix epididymis
  - located at superior pole of testicle
- ❑ diagnosis
  - aspirate contains sperm
  - transilluminates
- ❑ treatment
  - usually no treatment
  - excise only if symptomatic

**HERNIA** - see General Surgery Chapter

**Table 4. Differentiation between Hydrocele, Spermatocele, Hernia**

|                     | Palpation                                                                                                                                    | Transillumination |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| <b>Hydrocele</b>    | Testis is not separable from hydrocele<br>Spermatic cord is palpable above the swelling                                                      | +ve               |
| <b>Spermatocele</b> | Testis is separable from spermatocele<br>Spermatic cord is palpable above the swelling                                                       | +ve               |
| <b>Hernia</b>       | Testis is separable from hernia<br>Spermatic cord is not palpable above the swelling<br>Cough impulse may be transmitted<br>May be reducible | -ve               |

## VARICOCELE

- ❑ etiology
  - dilated veins in the pampiniform plexus (90% on left side); incompetent valves in testicular veins
  - left internal spermatic vein is longer and joins the left renal vein (on the right it empties into the vena cava)
  - rarely from retroperitoneal tumour
  - 10% incidence in young men
  - 30% of men with infertility have it (associated with testicular atrophy)
- ❑ diagnosis
  - usually asymptomatic, but may be painful
  - upright - mass of dilated, tortuous veins, "bag of worms"
  - heavy sensation after walking or standing
  - supine - venous distention abates
  - pulsates with Valsalva or cough
- ❑ treatment
  - surgical ligation of testicular vein above inguinal ligament
  - percutaneous vein occlusion (balloon catheter, sclerosing agents)
  - in the presence of oligospermia, surgically correcting the varicocele may improve sperm count and motility in 50-75% of patients

# PENIS AND URETHRA

## PEYRONIE'S DISEASE

### Etiology

- inflammatory process involving the tunica albuginea secondary to penile trauma  
—> result in fibrotic plaque formation
- commonly on dorsal surface resulting in upward curvature of erect penis due to scar tissue
- chordee = ventral bend
- in children, chordee associated with hypospadias (1/300) (not Peyronie's disease)

### Presentation

- painful erection, penis curvature, poor erection distal to plaque

### Treatment

- watchful waiting (spontaneous resolution in 50% of patients)
- vitamin E, potassium paraaminobenzoate —> both limited success
- intralesional verapamil
- surgical excision of plaque, prosthesis for erectile dysfunction 2° to cavernosal damage (wait 1 year to allow for spontaneous resolution or failure of medical treatment prior to initiation of surgical treatment)

## PRIAPISM

### Definition

- UROLOGICAL EMERGENCY
- painful tumescence (swelling) of corpora cavernosa with flaccid glans penis (no corpora spongiosum involvement) lasting > 4 hours without sexual desire

### Etiology

- 60% idiopathic
- intracorporeal drug injection (papaverine, phentolamine, PGE1 = triple mix)
- increased incidence with
  - sickle cell disease, leukemia
  - pelvic tumours, pelvic infections
  - penile trauma, spinal cord trauma
  - drug-related (e.g. chlorpromazine, trazadone, hydralazine, guanethidine, prazosin, EtOH, heparin)

### Treatment

- sedation, local anesthetic (without epinephrine)
- needle aspiration and drainage
- intracorporeal injection with phenylephrine ( $\alpha$  adrenergic agonist —> vasoconstrict)
- cavernosal-spongiosal shunt if necessary (drain through spongiosum)
- STAT leukopheresis if leukemia
- exchange transfusion if sickle cell anemia crisis

### Complication

- erectile dysfunction due to corporal fibrosis if treatment delayed (50%)  
—> risk increases significantly if delayed > 24-48 h

## PHIMOSIS

### Definition

- inability to retract foreskin over glans penis
- may occur due to or be caused by balanitis (infection of glans)
- normal congenital adhesions separate naturally by 1-2 years of age

### Treatment

- circumcision, proper hygiene

### Complications

- balanoposthitis (inflammation of prepuce), paraphimosis, penile cancer

## PARAPHIMOSIS

### Definition

- UROLOGICAL EMERGENCY
- foreskin caught behind glans leading to edema; unable to reduce foreskin

### Treatment

- analgesia
- squeeze edema out of the glans with manual pressure
- pull on foreskin with fingers while pushing on glans with thumbs —> if fails, do dorsal slit
- elective circumcision for definitive treatment, as paraphimosis tends to recur

### Complication

- infection, glans ischemia, gangrene

### PENILE TUMOURS

- ❑ rare (< 1% of cancer in males in U.S.), most common in 6th decade

#### Benign

- ❑ cyst, hemangioma, nevus, papilloma

#### Pre-malignant

- ❑ balanitis xerotica obliterans, leukoplakia, Buschke-Lowenstein tumour (large condyloma)
- ❑ carcinoma in situ (CIS)
  - Bowen's disease → crusted, red plaques on the shaft
  - erythroplasia of Queyrat → velvet red, ulcerated plaques on the glans
  - treatment options: local excision, laser, radiation, topical 5-fluorouracil

#### Malignant

- ❑ 2% of all urogenital cancers
- ❑ risk factors: chronic inflammatory disease, STD, phimosis, uncircumsised penis
- ❑ squamous cell (> 95%), basal cell, Paget's disease, melanoma
- ❑ definitive diagnosis requires full thickness biopsy of lesion
- ❑ TMN staging
  - Tx – primary tumour cannot be assessed
  - T0 – no evidence of primary tumour
  - Tis – CIS
  - Ta – non-invasive carcinoma
  - T1 – tumour invades subepithelial connective tissue (Buck's and Dartos fascia)
  - T2 – tumour invades corpus spongiosum, cavernosum, or urethra (through tunica albuginea)
  - T3 – tumour invades urethra or prostate
  - T4 – tumour invades other adjacent structures
  - N – presence (+) or absence (0) of lymph node metastasis
  - M – presence (+) or absence (0) of distant metastasis (lung, liver, bone, brain)
- ❑ lymphatic spread (superficial/deep inguinal nodes → iliac nodes) >> hematogenous
- ❑ treatment: wide surgical excision with tumour-free margins (dependant on extent and area of penile involvement) +/- lymphadenectomy

### ERECTILE DYSFUNCTION

#### Definition

- ❑ consistent (> 3 months duration) inability to obtain or sustain an adequate erection for intercourse
- ❑ physiology (mnemonic: parasympathetics point and sympathetics / somatics shoot)
  - erection (= POINT)
    - release of NO by activated parasympathetics increased cGMP levels
      - within corpora cavernosa: 1) arteriolar dilatation and
      - 2) relaxation of the sinusoidal smooth muscle → increased arterial inflow
    - compression of penile venous drainage → decreased venous outflow
  - emission (= SHOOT)
    - sensory from glans
    - secretions from prostate, seminal vesicles, and ejaculatory ducts enter prostatic urethra (sympathetics)
  - ejaculation (= SHOOT)
    - bladder neck closure (sympathetic control)
    - spasmodic contraction of bulbo-cavernosus and pelvic floor musculature (somatic control)

#### Classification

- ❑ psychogenic (10%)
  - EtOH, tension, and/or premature ejaculation often involved
  - patient usually characterized by:
    - younger age
    - intermittent difficulty
    - no risk factors for organic disease
    - nocturnal penile tumescence present
    - often able to achieve erection using self-stimulation
- ❑ organic (90%)
  - endocrine: diabetes (20%), gonadal or pituitary dysfunction
  - vasculogenic (12%): arterial insufficiency, atherosclerosis
  - neurogenic: multiple sclerosis, spinal cord injury
  - iatrogenic: drugs (antihypertensives, sedatives, psychotropics), radiation, pelvic surgery (radical prostatectomy)
  - penile: post-priapism, Peyronie's
  - patient usually characterized by
    - older age (> 50 years old)
    - constant difficulty
    - risk factors present (atherosclerosis, HTN, DM)
- ❑ mixed (frequent)

### Investigations

- ☐ complete sexual, medical, and psychosocial history
- ☐ self-administered questionnaires (International Index of Erectile Function, Sexual Health Inventory for Men Questionnaire, ED Intensity Scale, ED Impact Scale)
- ☐ focused physical exam
- ☐ hypothalamic-pituitary-gonadal axis evaluation: testosterone (free and total), prolactin, LH, FSH
- ☐ risk factor evaluation: fasting blood glucose or HbA1C, cholesterol profile
- ☐ other: TSH, CBC, urinalysis
- ☐ usually unnecessary to do further testing except in special circumstances
- ☐ non-invasive
  - nocturnal penile tumescence monitor
- ☐ invasive
  - intracavernous injection of papaverine or PGE1 – r/o significant arterial or venous impairment
  - doppler studies pre- and post- papaverine injection – cavernosal anatomy and arterial flow evaluation (penile-brachial index < 0.6 suggestive of vascular cause)
  - angiography of pudendal artery post papaverine injection – posttraumatic ED evaluation
  - dynamic cavernosometry and cavernosography – to evaluate leakage from penile veins

### Treatment

- ☐ psychological (sexual counseling and education)
- ☐ oral medication
  - sildenafil (Viagra): inhibits phosphodiesterase type 5 which is responsible for cGMP degradation → increased cGMP levels → erection (contraindicated in men on nitrates/NTG → severe hypotension)
  - yohimbine: alpha adrenergic blocker
  - trazodone: serotonin antagonist and reuptake inhibitor
- ☐ intracorporal vasodilator injection/self-injection
  - triple therapy (papaverine, phentolamine, PGE1) or PGE1 alone
  - complications
    - priapism (overdose)
    - thickening of tunica albuginea at site of repeated injections (Peyronie's plaque)
    - hematoma
- ☐ vacuum devices: draw blood into penis via negative pressure, then put ring at base of penis
- ☐ implants (last resort): malleable or inflatable
- ☐ vascular surgery: microvascular arterial bypass and venous ligation (investigational)

### URETHRITIS

- ☐ women: vaginitis accounts for 1/3; remaining 2/3 due to gonorrhea or chlamydial infection (see Gynecology Chapter)
- ☐ men: gonococcal vs. non-gonococcal urethritis
  - gonococcal
    - causative organism = *Neisseria gonorrhea*
    - Dx – Hx of sexual contact, yellow purulent d/c, dysuria, frequency, positive Gram stain and/or culture from urethral specimen (gram negative diplococci)
    - treatment – Ceftriaxone 250 mg IM once + Doxycycline 100 mg PO bid x 7d to cover for chlamydia (can substitute Ofloxacin 400 mg or Ciprofloxacin 500 mg for Ceftriaxone)
  - non-gonococcal
    - causative organism = usually *Chlamydia trachomatis*
    - Dx – Hx of sexual contact, mucoid whitish purulent d/c, with or without dysuria, frequency, Gram stain demonstrates > 4 PMN/oil immersion field, no evidence of *N. gonorrhea*
    - treatment – Doxycycline 100 mg PO bid x 7d (can use erythromycin 500 mg qid or tetracycline 500 mg qid for same duration)

### URETHRAL SYNDROME

- ☐ dysuria in females with consistently sterile urine cultures or low bacterial counts
- ☐ some have bacterial urethrocystitis (*C. trachomatis* or other organisms) and require antimicrobial treatment
- ☐ treatment
  - tetracycline or erythromycin
- ☐ rule out psychological, vaginitis, cancer, interstitial cystitis

### URETHRAL STRICTURE

- ☐ involves fibrosis formation in corpus spongiosum secondary to direct extravasation of urine through urethral mucosa and may involve urethral epithelium
  - infection of urethral glands → microabscess formation → periurethral fibrosis extension
- ☐ contraction of this scar will decrease size of urethral lumen
- ☐ more common in males

### Etiology

- ☐ congenital
  - failure of normal canalization
  - may cause hydronephrosis
  - treat at time of endoscopy with dilatation, internal urethrotomy
- ☐ trauma
  - instrumentation (most common, at fossa navicularis)
  - external trauma
    - urethral trauma with stricture formation
- ☐ infection
  - common with gonorrhea in the past (not common now)
  - long-term indwelling catheter
  - balanitis xerotica obliterans - causes meatal stenosis

### Diagnosis and Evaluation

- ☐ signs and symptoms
  - decreased force/amount of urinary stream
  - spraying
  - double stream
  - post-void dribbling
  - related infections: recurrent UTI, secondary prostatitis / epididymitis
- ☐ laboratory findings
  - flow rates < 10 mL/s (normal = 20 mL/s)
  - urine culture usually negative, but may show pyuria
- ☐ radiologic findings
  - urethrogram, VCUG will demonstrate location
- ☐ urethroscopy

### Treatment

- ☐ urethral dilatation
  - temporarily increases lumen size by breaking up scar tissue
  - healing will reform scar tissue and recreate stricture
  - not usually curative
- ☐ visual internal urethrotomy (VIU)
  - endoscopically incise stricture without skin incision
  - only single, short (< 1 cm), bulbar urethra strictures respond
  - cure rate 50-80% with single treatment, < 50% with repeated courses
- ☐ open surgical reconstruction
  - complete stricture excision for all, then (dependent on location and size of stricture):
    - membranous urethra – end-to-end anastomosis
    - bulbar urethra < 2 cm – end-to-end anastomosis
    - bulbar urethra > 2 cm or penile urethra – 1) vascularized flap of local genital skin or 2) free graft (penile shaft skin or buccal mucosa) - preferred

## URETHRAL TRAUMA

### Etiology

- ☐ most common site is membranous or proximal bulbar urethra due to blunt trauma, MVAs
  - associated with pelvic fractures (10% of such fractures)
- ☐ other causes: iatrogenic instrumentation, prosthesis insertion, penile fracture, masturbation with urethral manipulation
- ☐ always look for associated bladder rupture

### Diagnosis

- ☐ do not perform cystoscopy or catheterization before retrograde urethrography if urethral trauma suspected
- ☐ signs and symptoms
  - high riding prostate
  - blood at urethral meatus
  - sensation of voiding without urine output
  - swelling and butterfly perineal hematoma
- ☐ retrograde urethrography
  - demonstrates extravasation and location of injury

### Treatment

- ☐ simple contusions - no treatment
- ☐ partial urethral disruption
  - with no resistance to catheterization - Foley x 2-3 weeks
  - with resistance to catheterization
    - suprapubic cystostomy or urethral catheter alignment in O.R.
    - periodic flow rates/urethrograms to evaluate for stricture formation
- ☐ complete disruption
  - immediate repair if patient stable, delayed repair if unstable

# HEMATURIA

**Classification** (see [Nephrology](#) Chapter)

**Table 5. Etiology of Hematuria by Age Group**

| Age (years)   | Etiology (in order of decreasing frequency)                              |
|---------------|--------------------------------------------------------------------------|
| <b>0-20</b>   | Glomerulonephritis, UTI, congenital anomalies                            |
| <b>20-40</b>  | UTI, stones, bladder tumour                                              |
| <b>40-60</b>  | Male: bladder tumour, stones, UTI<br>Female: UTI, stones, bladder tumour |
| <b>&gt;60</b> | Male: BPH, bladder tumour, UTI<br>Female: bladder tumour, UTI            |

## Etiology

- ☐ pseudohematuria
  - menses
  - dyes (beets, rhodamine B in drinks, candy and juices)
  - hemoglobin (hemolytic anemia)
  - myoglobin (rhabdomyolysis)
  - porphyria
  - laxatives (phenolphthalein)
- ☐ based on source of bleeding
  - pre-renal
    - throughout urinary stream
    - anticoagulants
    - coagulation defects
    - sickle cell disease
    - leukemia
  - renal
    - throughout urinary stream
    - renal cell carcinoma, transitional cell carcinoma, Wilm's tumour, pyelonephritis, tuberculosis, glomerulonephritis, trauma, stone, infarct, polycystic kidneys, arteriovenous malformation
  - ureter
    - stone, tumour
  - bladder
    - cystitis, tumour, stone, polyps
  - urethra
    - urethritis, stone, tumour, urethral stricture
- ☐ timing to urinary stream
  - initial - anterior urethral lesions
  - terminal - bladder neck/trigone
  - total - bladder and/or above bladder

## Diagnosis

- ☐ history
  - timing to urinary stream
  - flank pain
  - provoking factors (e.g. exercise, trauma)
  - irritative or obstructive symptoms
  - previous kidney or urologic disease
  - history of recent UTI, STDs, TB exposure, pelvic irradiation, bleeding diathesis, smoking
  - drugs (NSAIDs, anticoagulants)
  - family history: diabetes, sickle cell anemia, polycystic kidney disease, urinary tract calculi
- ☐ physical exam
  - vitals - fluid status, blood pressure, temperature
  - abdominal exam - abdominal masses (including renal or bladder) or tenderness
  - GU exam - DRE for prostate, external genitalia in males

## HEMATURIA . . . CONT.

### Investigations

- ☐ CBC (rule out anemia, leukocytosis)
- ☐ chemistry: electrolytes, creatinine, BUN
- ☐ urinalysis: (the 4 Cs)
  - casts vs. RBCs
  - crystals
  - culture and sensitivity
  - cytology
- ☐ ultrasound to investigate upper tracts
- ☐ CT with contrast to investigate renal parenchymal masses
- ☐ cystoscopy
- ☐ intravenous pyelogram (IVP)

### Acute Management of Severe Bladder Hemorrhage

- ☐ secondary to advanced bladder ca. or hemorrhagic cystitis
- ☐ hand irrigation with normal saline to remove clots
- ☐ start CBI (continuous bladder irrigation) using 22-26Fr 3-way Foley if bleeding is minimal
- ☐ cystoscopy if bleeding quite active
  - resect resectable tumours
  - coagulate obvious sites of bleeding
- ☐ continuous intravesical irrigation with 1% alum (aluminum potassium sulfate) solution as needed
- ☐ intravesical instillation of 1% silver nitrate solution
- ☐ intravesical instillation of 1-4% formalin (need general anesthesia)
- ☐ embolization or ligation of iliac arteries
- ☐ cystectomy

### Clinical Pearl

- ☐ **In patients with hematuria, particularly if over age 40, malignancy must be ruled out, especially bladder tumours.**

## INFERTILITY

- ☐ failure to conceive after one year of unprotected, properly timed intercourse
- ☐ primary vs. secondary (see Gynecology Chapter)
- ☐ incidence
  - 15% of all couples - investigate both partners
  - 1/3 female, 1/3 male, 1/3 combined problem

### Male Reproduction

- ☐ hypothalamus-pituitary axis
- ☐ LH → Leydig (interstitial) cells → testosterone synthesis/secretion
- ☐ FSH → Sertoli cells → structural and metabolic support to developing spermatogenic cells
- ☐ sperm route: epididymis → vas deferens → ejaculatory ducts → prostatic urethra

### Etiology

- ☐ hormonal (see Endocrinology Chapter)
  - hypothalamic-pituitary-testicular axis (2-3%) (increased temperature)
- ☐ testicular
  - varicocele (40% infertile males)
  - tumour
  - congenital (Klinefelter's triad: small, firm testes, gynecomastia and azoospermia)
  - cryptorchidism
  - post infectious (epididymo-orchitis, STDs)
  - torsion not corrected within 6 hrs
- ☐ iatrogenic
  - radiation, antineoplastic and antiandrogen drugs can interfere with sperm transport and production
- ☐ lifestyle ("bad habits")
  - drugs (marijuana, cocaine, tobacco, EtOH, prescription)
  - increased testicular temperature (sauna, hot baths, tight pants/briefs)
- ☐ surgical complications
  - testes (vasectomy, hydrocelectomy)
  - inguinal (inadvertant ligation of vas deferens)
  - bladder/prostate (damage to bladder neck causing retrograde ejaculation, damage to ejaculatory ducts)
  - abdomen (damage to sympathetic nerves causing retrograde ejaculation)
- ☐ transport
  - cystic fibrosis (typical - obstructive azoospermia; atypical – congenital absence of the vas deferens, bilateral ejaculatory duct obstruction, or bilateral obstructions within the epididymis)
  - Kartagener's syndrome
  - congenital absence of vas deferens, obstruction of vas deferens

## INFERTILITY ... CONT.

### Investigations

- normal semen analysis (at least 2 specimens)
  - volume: 2-5 mL
  - concentration: > 20 million sperm/mL
  - morphology: > 30% normal forms
  - motility: > 50% (most important abnormality)
  - liquefaction: complete in 20 minutes
  - pH: 7.2-7.8
  - WBC: < 10 per high power field or < 10<sup>6</sup> WBC/ml semen
- hormonal evaluation
  - testosterone for evaluation of HPA
  - FSH measures state of sperm production
  - serum LH and prolactin are measured if testosterone or FSH are abnormal
- chromosomal studies (Klinefelter's Syndrome - XXY)
- immunologic studies (antisperm antibodies in ejaculate and blood)
- testicular biopsy
- scrotal U/S (varicocele, testicular size)
- vasography (assess patency of vas deferens)

### Treatment

- ☐ lifestyle
  - regular exercise, healthy diet
  - cut out "bad habits"
- ☐ medical
  - endocrine therapy (see Endocrinology Chapter)
  - therapy for retrograde ejaculation (finding of sperm within postejaculate bladder urine)
  - discontinue anti-sympathomimetic agents, may start alpha-adrenergic stimulation (phenylpropanolamine, pseudoephedrine, or ephedrine)
  - treat underlying infections
- ☐ surgical
  - varicocelectomy
  - vasovasostomy (vasectomy reversal)
  - epididymovasostomy
  - transurethral resection of blocked ejaculatory ducts
- ☐ assisted reproductive technologies (ART) —> refer to Ob/Gyn specialist
  - sperm washing + intrauterine insemination (IUI)
  - in vitro fertilization (IVF)
  - intracytoplasmic sperm injection (ICSI)

## PEDIATRIC UROLOGY

### CONGENITAL ABNORMALITIES

- ☐ not uncommon; 1/200 have congenital abnormalities of the GU tract
- ☐ UTI is the most common presentation postnatally
- ☐ hydronephrosis is the most common finding antenatally

### HYPOSPADIAS

- ☐ very common; 1/300
- ☐ multifactorial genetic mode of inheritance
- ☐ a condition in which the urethral meatus opens on the ventral side of the penis, proximal to the glans penis
- ☐ classified to location of meatus as
  - glandular
  - coronal (+ glandular = 75%)
  - penile
  - penoscrotal
  - perineal
- ☐ may be associated with chordee, intersex states, undescended testicles or inguinal hernia
- ☐ depending on the severity, there may be difficulty directing the urinary stream or even infertility (long-term)
- ☐ treatment is surgical correction – optimal repair before 2 years old
- ☐ circumcision should be deferred because the foreskin may be utilized in the correction

### EPISPADIAS-EXSTROPHY COMPLEX

- ☐ incidence 1/30,000, 3:1 male to female predominance
- ☐ represents failure of closure of the cloacal membrane, resulting in the bladder and urethra opening directly through the abdominal wall
- ☐ high morbidity —> incontinence and infertility
- ☐ treatment: surgical correction, possible gender reassignment

**ANTENATAL HYDRONEPHROSIS**

- ☐ 1% of fetuses – detectable on U/S as early as first trimester
- ☐ unilateral or bilateral
- ☐ differential diagnosis:
  - UPJ or UVJ obstruction
  - multi-cystic kidney
  - reflux
  - PUV
  - duplication anomalies
- ☐ antenatal in utero intervention rarely indicated

**POSTERIOR URETHRAL VALVES**

- ☐ the most common obstructive urethral lesion in infants
- ☐ abnormal mucosal folds at the distal prostatic urethra causing varying degrees of obstruction
- ☐ presents with obstructive symptoms, UTI, or complications of obstruction (depending on the severity)
- ☐ associated findings:
  - oligohydramnios – due to low intrauterine production of urine
  - renal dysplasia – due to high pressure reflux
- ☐ now detected antenatally → bilateral hydronephrosis
- ☐ diagnosis: VCUG → dilated posterior urethra, reflux
- ☐ treatment
  - immediate catheterization to relief obstruction, followed by cystoscopic resection of PUV

**UPJ OBSTRUCTION**

- ☐ twice as common in males than females
- ☐ the most common congenital defect of the ureter
- ☐ unclear etiology: ? adynamic segment of ureter, stenosis, strictures, aberrant blood vessels
  - extrinsic compression
- ☐ symptoms depend on severity and age of diagnosis
  - infants: abdominal mass, urinary infection
  - children: pain, vomiting, failure to thrive
- ☐ diagnosis: U/S, renal scan +/- furosemide
- ☐ treatment: surgical correction (pyeloplasty)
- ☐ prognosis: good, usually unilateral disease

**VESICoureTERAL REFLUX (VUR)**

- ☐ condition wherein urine passes retrograde from the bladder through the UVJ into the ureter
- ☐ present in 50% of children with UTI
- ☐ 30-50% of children with reflux will have renal scarring
- ☐ common causes: trigonal weakness, lateral insertion of the ureters, short submucosal segment (all part of “primary reflux”)
- ☐ many other causes including secondary reflux, subvesical obstruction, iatrogenic, secondary to ureteric abnormalities (e.g. ureterocele, ectopic ureter, or duplication), and secondary to cystitis
- ☐ symptoms
  - UTI, urosepsis
  - pyelonephritis
  - pain on voiding
  - symptoms of renal failure (uremia, hypertension)
- ☐ diagnosis and staging is done using VCUG, +/- U/S
- ☐ grading based on cystogram
  - grade I: ureters only fill
  - grade II: ureters and pelvis fill
  - grade III: ureters and pelvis fill with some dilatation
  - grade IV: ureters pelvis and calyces fill with significant dilatation
  - grade V: ureters, pelvis and calyces fill with major dilatation and tortuosity
- ☐ complications
  - pyelonephritis
  - hydroureteronephrosis
- ☐ management
  - many children “outgrow” reflux (60% of primary reflux)
  - annual renal U/S and VCUG/RNC to monitor; renal scan if suspect new renal scar (episode of pyelonephritis)
  - treatment choice is dependent on the grade
    - medical (grade I to III) - goal is to keep urine free of infectoin to prevent renal damage while waiting for child to “outgrow” their reflux
      - long term antibiotic prophylaxis at half the treatment dose for half the treatment time (TMP/SMX, amoxicillin, or nitrofurantoin)
    - surgical (ureteroneocystostomy +/- ureteroplasty)
      - indications
        - failure of medical management
        - new renal scars
        - breakthrough infections
        - high grade reflux (grade IV or V)
- ☐ prognosis depends on degree of damage done at the time of diagnosis

## URINARY TRACT INFECTION (see Pediatrics Chapter)

### ENURESIS

- ☐ age and culture related
- ☐ commonest cause: maturational lag in CNS influence on bladder
- ☐ treatment
  - rule out organic causes (UTI, reflux, bladder outlet obstruction, neurologic diseases), explore psychological/psychiatric causes
  - positive reinforcement for dry days
  - bladder training - voiding schedule +/- portable wetting alarm if nocturnal
  - pharmacotherapy: oxybutynin (Ditropan) if daytime or DDAVP spray (rarely indicated)

### NEPHROBLASTOMA (WILM'S TUMOUR)

- ☐ arises from abnormal proliferation of metanephric blastoma
- ☐ 5% of all childhood cancers, 5% bilateral
- ☐ average age of incidence is 3 years
- ☐ 1/3 hereditary (autosomal dominant) and 2/3 sporadic
  - familial form associated with other congenital abnormalities and gene defects
- ☐ presentation
  - abdominal mass: large, firm, unilateral (most common presentation – 80%)
  - hypertension (60%)
  - flank tenderness
  - microscopic hematuria
  - nausea/vomiting
- ☐ treatment
  - always investigate contralateral kidney
  - treatment of choice is simple nephrectomy +/- radiation +/- chemotherapy
- ☐ prognosis
  - generally good; overall 5-year survival about 80%
  - metastatic disease may respond well

### CRYPTORCHIDISM / ECTOPIC TESTES

- ☐ cryptorchidism refers to testes located somewhere along the normal path of descent (prepubic > external inguinal ring > inguinal canal > abdominal)
- ☐ ectopy of testis is rare – testis found outside its normal path of descent
- ☐ incidence
  - 2.7% of full term newborns
  - 0.7%-0.8% at 1 year old
- ☐ consider
  - retractile testes
  - atrophic testes
  - intersex states
- ☐ treatment
  - undescended testes must be brought down before age 1-2 years as irreversible changes occur; after age 2 they should be brought down to monitor for malignancy
  - hormonal therapy (hCG or LH may facilitate their descent)
  - surgical descent (orchiopexy)
- ☐ prognosis
  - untreated bilateral cryptorchidism ~ 100% infertility
  - treated bilateral: 60-70% fertility rate
  - treated/untreated unilateral: fertility is still less than the general population
  - risk of malignancy is 10-40 x increased in undescended testes; this risk does not decrease with surgical descent, but monitoring is made easier
  - increased risk of testicular torsion  
(always perform bilateral orchiopexy for prevention if doing orchiopexy for torsion)

### AMBIGUOUS GENITALIA

#### Definition and Classification

- ☐ genitalia that do not have a normal appearance based on the chromosomal sex of the child due to the undermasculinization of genetic males or the virilization of genetic females
- ☐ 4 major categories
  - male pseudohermaphroditism (all 46 XY, testis only)
    - defect in testicular synthesis of androgens
    - androgen resistance in target tissues
    - palpable gonad
  - female pseudohermaphroditism (all 46 XX, ovary only)
  - most due to congenital adrenal hyperplasia (21-hydroxylase deficiency most common enzymatic defect) —> shunt in steroid biosynthetic pathway leading to excess androgens
  - true hermaphroditism (46 XX most common karyotype, ovary plus testis)
  - mixed gonadal dysgenesis (46 XY/45 XO most common karyotype)
    - presence of Y chromosome —> partial testis determination to varying degrees

### Diagnosis and Treatment

- ☐ thorough maternal and family history needed
  - other forms of abnormal sexual development
  - maternal medication or drug use in pregnancy → maternal hyperandrogenemia
  - parent consanguinity
- ☐ physical exam: palpable gonad (=chromosomal male), hyperpigmentation, evidence of dehydration, hypertension, stretched phallus length, position of urethral meatus
- ☐ chromosomal evaluation – sex karyotype
- ☐ laboratory tests
  - plasma 17-OH-progesterone (after 36 hours of life) → increased in 21-hydroxylase deficiency
  - plasma 11-deoxycortisol → increased in 11-beta-hydroxylase deficiency
  - basal adrenal steroid levels
  - serum testosterone and DHT pre- and post-hCG-stimulation (2,000 IU/day for 4 days)
  - serum electrolytes
- ☐ ultrasound of adrenals, gonads, uterus, and fallopian tubes
- ☐ endoscopy and genitography of urogenital sinus
- ☐ sex assignment (with extensive family consultation)
  - must consider capacity for sexually functioning genitalia in adulthood
- ☐ reconstruction of external genitalia – between 6-12 months old
- ☐ long term psychological guidance and support for both patient and family

## SURGICAL PROCEDURES

### Cystoscopy

- ☐ objective: endoscopic inspection of the lower urinary tract (urethra, prostate, bladder neck, walls and dome, and ureteral orifices) using irrigation, illumination, and optics
  - scopes can be flexible or rigid and typically use 0-, 30-, 70-, and 120-degree lenses
- ☐ indications
  - hematuria (gross or microscopic)
  - voiding symptoms (irritative or obstructive)
  - urethral and bladder neck strictures
  - urolithiasis
  - bladder tumour surveillance
  - evaluation of upper tracts with retrograde pyelography (ureteral stents, catheters)
- ☐ complications
  - intraoperatively
    - infection, bleeding, anesthetic-related
    - perforation (rare)
  - post-operatively (short-term)
    - epididymo-orchitis (rare)
    - urinary retention
  - post-operatively (long-term)
    - stricture

### Radical Prostatectomy

- ☐ objective and indications: a form of treatment for localized prostate cancer
  - the entire prostate and prostatic capsule are removed via a lower midline abdominal incision
  - internal iliac and obturator vessel lymph nodes are also dissected and sent for pathology
  - seminal vesicle vessels are also ligated
- ☐ complications
  - immediate (intraoperative)
    - blood loss
    - rectal injury
    - ureteral injury (extremely rare)
  - perioperative
    - lymphocele formation
  - late
    - total urinary incontinence (< 3%)
    - stress urinary incontinence (20%)
    - erectile dysfunction (50%, depending on whether one, both, or neither of the neurovascular bundles are involved in extracapsular extension of tumour)

## SURGICAL PROCEDURES ... CONT.

### Transurethral Resection of the Prostate (TURP)

- ☐ objective: to partially resect the periurethral area of the prostate (transition zone) to decrease symptoms of urinary tract obstruction. This is accomplished via a cystoscopic approach using an electrocautery loop, irrigation, and illumination
- ☐ indications
  - obstructive uropathy (large bladder diverticula, renal insufficiency)
  - refractory urinary retention
  - recurrent UTIs
  - recurrent gross hematuria
  - bladder stones
- ☐ complications
  - acute
    - intra - or extraperitoneal rupture of the bladder
    - rectal perforation
    - incontinence
    - incision of the ureteral orifice (with subsequent reflux or ureteral stricture)
    - hemorrhage
    - gas explosion
    - epididymitis
    - sepsis
    - transurethral resection syndrome (also called "post-TURP syndrome")
      - caused by absorption of a large volume of the hypotonic irrigation solution used, usually through perforated venous sinusoids leading to a hypervolemic hyponatremic state
      - characterized by delusional hyponatremia, confusion, nausea, vomiting, hypertension, bradycardia, visual disturbances, CHF, and pulmonary edema
    - treat with diuresis and (if severe) hypertonic saline administration
  - chronic
    - retrograde ejaculation (> 75%)
    - erectile dysfunction (5-10% risk increases with increasing use of cautery)
    - incontinence (< 1%)
    - urethral stricture
    - bladder neck contracture

### Vasectomy and Vasovasostomy

- ☐ objective and indications: ligation of the vas deferens for the purpose of contraception
- ☐ approximately 750,000 are performed each year
- ☐ 5% of these men will have their vasectomy reversed with a vasovasostomy procedure
- ☐ infection, deformities, trauma, and previous surgery are less frequent indications for a vasovasostomy
- ☐ complications of vasectomy among those who wish to have a reversal is "blowout"
  - sperm trying to drain from the testis into a ligated vas may cause "back pressure" behind the blocked vas deferens
  - this may cause a blowout at some point in the delicate epididymal tubule
  - treatment is epididymovasostomy

### Circumcision

- ☐ objective
  - to remove the penile foreskin for religious, cultural or personal reasons
  - associated with a decreased incidence of penile cancer, STDs, balanitis and UTIs (12-fold)
  - good penile hygiene should be emphasized as the alternative
  - routine circumcision for prophylactic medical reasons is not recommended
- ☐ indications
  - absolute: balanitis xerotica obliterans
  - relative: recurrent balanitis, secondary phimosis, paraphimosis
- ☐ contraindications
  - hypospadias, chordee, dorsal hood deformity, webbed penis or micropenis
- ☐ anatomical landmarks
  - dorsal penile nerve block → local anesthetic + epinephrine (regardless of age)
- ☐ complications
  - rate = 0.2-3% hemorrhage, wound infection and surgical trauma to glans, shaft or urethra

## REFERENCES

<http://www.urologychannel.com>

<http://www.urology.com>

Macfarlane MT. *House Officer Series: Urology*. (3rd ed.) 2001. Philadelphia: Lippincott Williams & Wilkins.

Tanagho EA, McAninch JW. *Smith's General Urology*. (15th ed.) 2000. Norwalk: Appleton and Lange.

Walsh PC, Retik AB, Vaughan ED, and Wein AJ. *Campbell's Urology*. (7th ed.) 1998. Philadelphia: WB Saunders Co.